UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

JUN 10 2004

Mr. Ken S. Berg
Manager, Western Washington Fish and Wildlife Office
Fish and Wildlife Service
U. S. Department of the Interior
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503

Dear Mr. Berg:

This document transmits the biological opinion and essential fish habitat consultation prepared by the National Marine Fisheries Service (NMFS) issued under the authority of section 7 of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536), on approval of Puget Sound salmon fishing activities authorized by the U.S. Fish and Wildlife Service during the 2004 fishing season. The Incidental Take Statement included in the biological opinion establishes exploitation rate limits or escapement objectives for populations in the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU) which is listed as threatened under the ESA. The consultation is for the 2004 fishing year only (through April 30, 2005).

NMFS concludes in the biological opinion that Puget Sound salmon fisheries managed in 2004, if conducted consistent with the terms of the incidental take statement, are not likely to jeopardize the continued existence of the listed Puget Sound Chinook Salmon ESU, or to destroy or to adversely modify critical habitat. The Incidental Take Statement includes non-discretionary terms and conditions that must be applied to the proposed fisheries to provide an exemption from the prohibited acts outlined in section 9 of the ESA. The biological opinion also includes discretionary Conservation Recommendations that are intended to help your agency comply with the affirmative conservation responsibilities of section 7(a)(1) of the ESA.

As prescribed by section 7 regulations, consultation on activities authorized by the USFWS involving the 2004 Puget Sound salmon fisheries must be re-initiated if: (1) the amount or extent of taking specified in the Incidental Take Statement is exceeded for any of the actions identified in the biological opinion; (2) new information reveals effects of these actions that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) any of the identified actions are subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified actions.

Sincerely,

for D. Robert Lohn,
Regional Administrator

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

JUN 10 2004

Mr. Stan Speaks
Regional Director, Northwest Regional Office
Bureau of Indian Affairs
U.S. Department of the Interior
911 N.E. 11th Avenue
Portland, Oregon 97232-4169

Dear Mr. Speaks:

This document transmits the biological opinion and essential fish habitat consultation prepared by the National Marine Fisheries Service (NMFS) issued under the authority of section 7 of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536), on approval of programs administered by the Bureau of Indian Affairs that support tribal salmon fisheries in Puget Sound during the 2004 fishing season. The Incidental Take Statement included in the biological opinion establishes exploitation rate limits or escapement objectives for populations in the Puget Sound Chinook Salmon ESU which is listed as threatened under the ESA. The consultation is for the 2004 fishing year only (through April 30, 2005).

NMFS concluded in the biological opinion that Puget Sound salmon fisheries managed in 2004, if conducted consistent with the terms of the incidental take statement, are not likely to jeopardize the continued existence of the listed Puget Sound Chinook Salmon ESU, or to destroy or to adversely modify critical habitat. The Incidental Take Statement includes non-discretionary terms and conditions that must be applied to the proposed fisheries to provide an exemption from the prohibited acts outlined in section 9 of the ESA. The biological opinion also includes discretionary Conservation Recommendations that are intended to help your agency comply with the affirmative conservation responsibilities of section 7(a)(1) of the ESA.

As prescribed by section 7 regulations, consultation on the programs administered by the BIA involving the 2004 Puget Sound salmon fisheries must be re-initiated if: (1) the amount or extent of taking specified in the Incidental Take Statement is exceeded for any of the actions identified in the biological opinion; (2) new information reveals effects of these actions that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) any of the identified actions are subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified actions.

Sincerely,

Joe Scordino

for D. Robert Lohn,
Regional Administrator, Northwest Region

Enclosure

National Oceanic and Atmospheric Administration
National Marine Fisheries Service (NMFS)
Endangered Species Act (ESA) Section 7 Consultation
Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation

Action Agencies: Bureau of Indian Affairs (BIA)
U.S. Fish and Wildlife Service (USFWS)

Species/ESU Affected: Puget Sound Chinook Salmon *(Oncorhynchus tshawytscha)*

Activities Considered: Programs Administered by the Bureau of Indian Affairs that Support Puget Sound Tribal Salmon Fisheries and Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service in Puget Sound during the 2004 Fishing Season

Consultation Conducted by: The Sustainable Fisheries Division, Northwest Region,

Tracking Number:: F/NWR/2004/00627

Date: June 9, 2004

This document constitutes NMFS' biological opinion for two proposed Federal actions that are likely to adversely affect the listed Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU). The Federal actions are the administration of programs by the Bureau of Indian Affairs that support tribal salmon fisheries management in Puget Sound and the authorization of salmon fishing activities by the U.S. Fish and Wildlife Service in Puget Sound as a party to the Hood Canal Salmon Management Plan. NMFS concludes that these actions are likely to adversely affect, but not likely to jeopardize the continued existence of the Puget Sound Chinook Salmon ESU. NMFS also concludes that the proposed Puget Sound salmon fisheries would not adversely affect Essential Fish Habitat.

This biological opinion has been prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). It is based on information provided to NMFS by the Washington state and Puget Sound tribal fishery managers, published and unpublished scientific information on listed salmon in the action area, and other sources representing the best available scientific information. A complete administrative record of this consultation is on file with the Sustainable Fisheries Division, Seattle, Washington.

Joe Scordino for D. Robert Lohn
Regional Administrator

6/10/04
Date

Attachments

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sustainable Fisheries Division
7600 Sand Point Way N.E., Bldg. #1
Seattle, Washington 98115-0070

JUN - 9 2004

MEMORANDUM FOR: D. Robert Lohn,
Regional Administrator

FROM: Stephen P. Freese,
Acting Assistant Regional Administrator for Sustainable Fisheries

SUBJECT: Transmittal of Recommended Decision: Issuance of an Incidental Take Statement and Essential Fish Habitat Consultation for Programs Administered by the Bureau of Indian Affairs that Support Tribal Salmon Fisheries in Puget Sound and Puget Sound Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service during the 2004 Fishing Season.

Attached is the Section 7 consultation and Essential Fish Habitat (EFH) consultation package pertaining to the programs administered by the Bureau of Indian Affairs that support tribal salmon fisheries in Puget Sound and salmon fishing activities authorized by the U.S. Fish and Wildlife Service in Puget Sound during the 2004 fishing season. The incidental take statement establishes exploitation rate limits or escapement goal objectives on the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU) for the 2004 fishing season and expires at the end of that fishing season (May 1, 2005).

The consultation was conducted by the Northwest Region's Sustainable Fisheries Division (SFD). The biological opinion concludes that Puget Sound salmon fisheries managed in 2004, if conducted consistent with the terms of the incidental take statement, are not likely to jeopardize the continued existence of the listed Puget Sound Chinook Salmon ESU, or to destroy or to adversely modify critical habitat; nor are they likely to adversely affect EFH. Other listed ESUs affected by these actions are the subjects of existing no-jeopardy opinions. The opinion includes an Incidental Take Statement (ITS) which specifies the expected take resulting from the proposed fisheries for the Puget Sound Chinook Salmon ESU. Populations within the ESU have been stable or increasing in recent years under these exploitation rates, and the rates are consistent with exploitation rates in previous opinions where NMFS has reached a conclusion of no jeopardy.

Over the last several years, NMFS has developed Rebuilding Exploitation Rates (RER) for several chinook salmon populations in Puget Sound. The approach used to derive these RERs is designed to isolate the effects of harvest in order to ensure that harvest actions do not impede survival and recovery of the ESU given conditions in other mortality sectors affecting listed Puget Sound Chinook salmon. It also incorporates the concepts in NMFS' Viable Salmonid Populations document. Implementation of the RER is expected to result in escapements that, within 25 years (1) fall below critical levels 5% or less than with no fishing and either (2a) exceed viable levels 80% or more of the time or (2b) are below viable levels 10% or less often than would have occurred with no fishing. For Puget Sound populations, Puget Sound exploitation rates are below the RERs, but when combined with preceding ocean fisheries managed under the PFMC and Pacific Salmon Treaty, total exploitation exceeds RERs for three of the ten populations for which RERs have been derived. However, escapements are expected to be above the viable escapement threshold for two of the three populations for which the RERs are expected to be exceeded in 2004 and stable or increasing relative to recent years' average escapement for all three

populations. The analysis in the consultation suggests that conduct of the 2004 Puget Sound salmon fisheries will have little to no effect on the ability to achieve viability criteria for at least two to four populations in each major Puget Sound geographic region, representing the range of life history types within that region, as recommended by the Puget Sound Technical Recovery Team.

Controversial Issues: NMFS is currently evaluating a resource management plan (RMP) for the Puget Sound salmon fisheries affecting listed Puget Sound chinook salmon under Limit 6 of the ESA 4(d) Rule. NMFS anticipated completing its 4(d) determination and the associated EIS by the start of the 2004 fishing season. Because of delays in the receipt of the RMP, this did not occur so a one-year ESA section 7 consultation was conducted. The fisheries considered for this year are consistent with the management framework described in the RMP. The previous Puget Sound chinook harvest 4(d) determination was the subject of a settlement agreement between NMFS and Washington Trout, a Puget Sound environmental group. Washington Trout raised a legal issue with regard to conduct of a biological opinion on the 2004 fisheries, but it has subsequently been resolved with an addendum to the original settlement agreement.

Package Components (all attached):

(1) ESA Section 7/Magnuson-Stevens Act EFH consultations
(2) Notification letters to BIA and USFWS

Development and Final Clearance:

Lead staff: Susan Bishop (SFD, Fish Management Branch)
Final review of ESA section 7/Magnuson-Stevens EFH consultations

SFD Puget Sound Fishery Biologist (K. Schultz)	Full Review		05/25/04
SRD Puget Sound Fishery Biologist (T. Tynan)	Part Review		06/02/04
SRD/SFD QA/QC Coordinator (R. Bayley)	Waived	workload	05/24/04
PRD (G. Griffin)	Waived	resources	05/20/04
General Counsel NW (M. Bancroft)	Full Review		06/28/04

Fish Management Branch, Chief Susan Bishop for Peter Dygert 6/9/04
Date

Remaining Steps

(1) RA signature of opinion decision memorandum
(2) RA signature of letter to parties

SFD QA/QC Coordinator receives hard copies of all documents, including transmittal memos, for records.

cc: (w/o attachments)

NWR2 –	Steve Freese
"	Peter Dygert
"	Susan Bishop
"	Maryann Nickerson
NWR1 –	Robert Bayley

Endangered Species Act - Section 7 Consultation and
Magnuson-Stevens Act Essential Fish Habitat Consultation

BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

Effects of Programs Administered by the Bureau of Indian Affairs Supporting Tribal Salmon Fisheries Management in Puget Sound and Puget Sound Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service during the 2004 Fishing Season

Action Agencies: Bureau of Indian Affairs
U.S. Fish and Wildlife Service

Consultation Conducted by
National Marine Fisheries Service
Sustainable Fisheries Division

Date Issued: JUN 10 2004

Table of Contents

1 INTRODUCTION

NOAA's National Marine Fisheries Service (NMFS) is required under section 7 of the Endangered Species Act (ESA) to conduct consultations that consider the impacts of salmon fisheries to salmon species listed under the ESA. This biological opinion considers the effects of the Puget Sound salmon fisheries during the 2004 fishing season on the Puget Sound Chinook Salmon Evolutionarily Significant Unit (ESU). Impacts of the Puget Sound salmon fisehries on other listed salmon and steelhead species are addressed in other existing biological opinions (Table 1).

NMFS is consulting with the Bureau of Indian Affairs (BIA) and the U.S. Fish and Wildlife Service (USFWS) under section 7 of the ESA on the Federal actions of (1) programs administered by the BIA that support tribal salmon fisheries management in Puget Sound, and (2) authorization of salmon fishing activities in Puget Sound by the USFWS as a party to the Hood Canal Salmon Management Plan (U.S. v. Washington, Civil No. 9213; Order Re: Hood Canal Management Plan (July 2, 1986)).

2 CONSULTATION HISTORY

NMFS has considered the effects on salmon species listed under the ESA of these and other federal fisheries actions and issued biological opinions or 4(d) Rule determinations. Beginning with its biological opinion on the 2000 fishing season (May 1, 2000 through April 30, 2001), NMFS combined its consultation on Pacific coast salmon fisheries with those that occurred in Puget Sound for reasons of efficiency, because of the interrelated nature of the preseason planning processes, and to provide a more inclusive assessment of harvest-related impacts on the listed species. In April, 2001, NMFS approved the Pacific coast ocean and Puget Sound fisheries impacting the listed Hood Canal summer-run chum salmon ESU under Limit 6 of the ESA 4(d) rule (65 FR 42422, July 10, 2000). In a separate determination, NMFS approved under Limit 6 the Pacific coast ocean and Puget Sound salmon fisheries impacting listed Puget Sound Chinook salmon in 2001 for two years and for Puget Sound salmon fisheries in 2003 for one year. Therefore, take prohibitions described in section 9 of the ESA for the Puget Sound Chinook and Hood Canal summer-run chum salmon ESUs did not apply to these fisheries, as long as they were conducted in accordance with the joint resource management plans (RMP) provided by the Puget Sound treaty tribes and Washington Department of Fish and Wildlife (WDFW)(hereafter "co-managers") (WDFW/PNPTT 2000, WDFW/PSTT 2001) and approved by NMFS under the ESA 4(d) rule (NMFS 2001a, NMFS 2001b; NMFS 2003c) ('limit approval'). Southern U.S. fisheries (Pacific Coast ocean and Puget Sound) were managed to meet the Puget Sound Chinook and Hood Canal summer-run chum salmon harvest management objectives described in the RMPs.

The April, 2001 ESA 4(d) Rule limit approval for listed Hood Canal summer chum salmon remains in effect. However, NMFS' approval of the 2003 Puget Sound Chinook salmon RMP under Limit 6 of the ESA 4(d) Rule expired on May 1, 2004. The co-managers have provided a subsequent jointly-developed harvest RMP for Puget Sound commercial and recreational salmon, and steelhead net fisheries taking listed Puget Sound Chinook salmon to NMFS for consideration under Limit 6 of the Endangered Species Act (ESA) section 4(d) rule for the 2004-2009 fishing seasons. The RMP is currently undergoing an evaluation by NMFS that is scheduled to be completed in the fall of 2004, after the majority of the 2004 salmon fishing season has occurred. Therefore, this biological opinion considers the effects of only the 2004 fishing year (through April 30, 2005) on the Puget Sound Chinook Salmon ESU. A biological opinion on the Pacific Coast ocean fisheries was completed in April, 2004, prior to the scheduled opening of the fisheries on May 1, 2004. These ocean fisheries are considered in the environmental baseline

(NMFS 2004b).

The effects of Pacific Coast ocean and Puget Sound fisheries on the Snake River fall Chinook, Snake River spring/summer Chinook, Snake River sockeye, Sacramento River winter-run Chinook, Southern Oregon/Northern California Coast coho, Central California Coast coho, Oregon Coast coho, Central Valley Spring-run Chinook, California Coastal Chinook, Lower Columbia River Chinook, Upper Willamette River Chinook, Upper Columbia River spring-run Chinook, Columbia River chum, Ozette Lake sockeye and ten steelhead ESUs have been considered for ESA compliance in either long-term biological opinions or 4(d) rules (Table 1). Consequently, these ESUs will not be discussed further in this biological opinion. This biological opinion therefore considers the effects of the 2004 Puget Sound salmon fisheries only on the Puget Sound Chinook Salmon ESU.

Table 1. NMFS ESA decisions regarding ESUs affected by southern U.S. fisheries and duration of the 4(d) Limit determination or biological opinion (BO). Only those decisions currently in effect are included.

Date (Coverage)	Duration	Citation	ESU considered
March 8, 1996 (BO)	until reinitiated	NMFS 1996c	Snake River spring/summer and fall Chinook, and sockeye
April 28, 1999 (BO)	until reinitiated	NMFS 1999b	S. Oregon/N. California Coast coho Central California Coast coho Oregon Coast coho
April, 2000 (BO)	until reinitiated	NMFS 2000a	Central Valley spring-run Chinook California Coastal Chinook
April, 2001 (4(d) Limit)	until withdrawn	NMFS 2001b	Hood Canal summer-run chum
April, 2001 (BO)	until withdrawn	NMFS 2001c	Upper Willamette River Chinook Lower Columbia River Chinook Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run Chinook Ten listed steelhead ESUs
April, 2004 (BO)	until 2010	NMFS 2004c	Sacramento River winter-run Chinook

3 BIOLOGICAL OPINION

3.1 Description of the Proposed Action and Action Area

3.1.1 Proposed Action

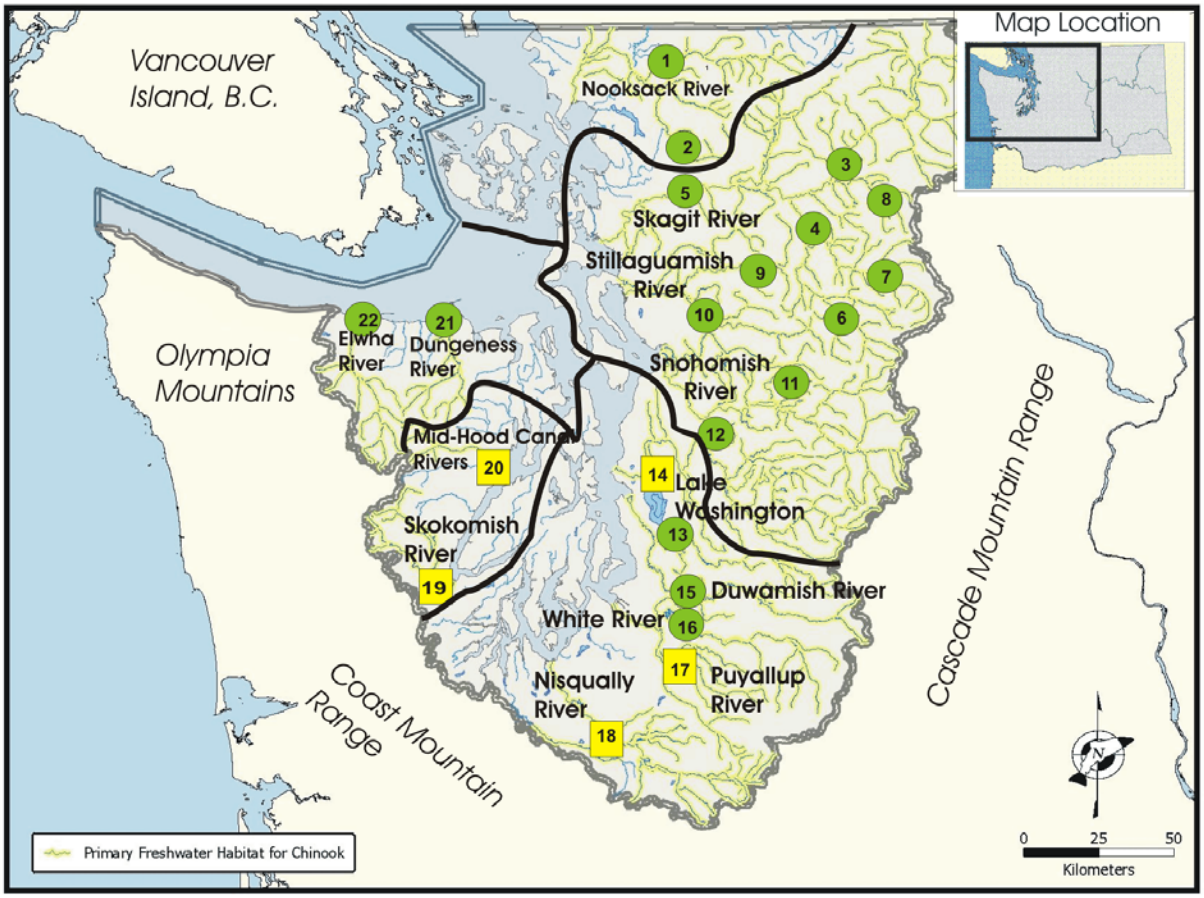
This biological opinion considers the effects of two federal actions on listed Puget Sound Chinook salmon: (1) programs administered by the BIA that support tribal salmon fisheries management in Puget Sound, and (2) authorization of salmon fishing activities in Puget Sound by the USFWS as a party to the Hood Canal Salmon Management Plan. The WDFW and the Puget Sound treaty tribes (co-managers) manage Puget Sound fisheries pursuant to the Puget Sound Salmon Management Plan (PSSMP) which was adopted by court order as a sub-proceeding related to U.S. v Washington (Civil No. C70-9213, Western District, Washington; see 384 Federal Supplement 312, Western District, Washington 1974). The purpose of the PSSMP is to establish guidelines for management of salmon and steelhead resources originating in Puget Sound. The PSSMP applies to all U.S. marine and freshwater fisheries in Puget Sound from the Strait of Juan de Fuca eastward. Fisheries within Puget Sound occur at different times throughout the year, depending on the location and the target species. The gear used varies by fishery but includes troll, hook and line, reef net, gill net, beach seine and purse seine. Puget Sound fisheries occur on all five salmon species, but the harvest of any particular species varies by location. The RMP currently under evaluation by NMFS is consistent with the PSSMP (PSIT/WDFW 2004) and the co-managers have stated that they will manage and implement the 2004 fisheries consistent with the proposed RMP.

The BIA administers programs that support fisheries management programs of the Puget Sound treaty tribes conducted under the PSSMP. The USFWS is party to the Hood Canal Salmon Management Plan (HCSMP) (U.S. v. Washington, Civil No. 9213; Order Re: Hood Canal Management Plan (July 2, 1986) which is a regional plan and stipulated court order related to the PSSMP. The federal, tribal and state parties to the HCSMP establish management objectives for populations originating in Hood Canal including listed Chinook salmon populations. Management under the HCSMP affects those fisheries where Hood Canal salmon populations are caught.

The BIA administration of programs that support tribal salmon fishing and, as a party to the HCSMP, USFWS' participation in the establishment of management objectives affecting listed Puget Sound Chinook salmon comprise the two federal actions considered in this biological opinion. The two actions have been grouped into this single biological opinion for efficiency and in compliance with the regulatory language of section 7, which allows NMFS to group similar, individual actions within a given geographic area or segment of a comprehensive plan (50 CFR 402.14(b)(6)).

3.1.2 Action Area

The action area for this biological opinion is the area defined by the Puget Sound Chinook Salmon ESU (Myers *et al.* 1998) and the western portion of the Strait of Juan de Fuca in in the U.S (Figure 1). The Puget Sound Action Area includes all marine waters of the State of Washington east of, and including the Strait of Juan de Fuca. The action area also includes all State of Washington freshwater tributaries of these marine waters east of the Strait of Juan de Fuca, and the freshwater tributaries of the Strait of Juan de Fuca east of, and including the Elwha River drainage.



Key: Draft chinook salmon populations (Puget Sound Technical Recovery Team, 2004a). Categories as defined by Sustainable Fisheries Division, NOAA Fisheries, NW Region.

1 - North Fork Nooksack River
2 - South Fork Nooksack River
3 - Upper Skagit River
4 - Lower Sauk River
5 - Lower Skagit River
6 - Upper Sauk River
7 - Siuattle River
8 - Upper Cascade River
9 - North Fork Stillaguamish River
10 - South Fork Stillaguamish River
11 - Skykomish River
12 - Snoqualmie River
13 - Cedar River
14 - Lake Washington Northern Tributaries
15 - Green River
16 - White River
17 - Puyallup River
18 - Nisqually River
19 - Skokomish River
20 - Mid-Hood Canal Rivers
21 - Dungeness River
22 - Elwha River

Category 1

Category 2

Figure 1. Location of Puget Sound Chinook salmon populations by watershed type, category, and geographic region.

3.2 Status of the Species and Critical Habitat

NMFS has determined that the actions being considered in this biological opinion may adversely affect the Puget Sound Chinook Salmon ESU which is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.; ESA) (see Table 2). Other listed salmon species affected by the proposed actions have been addressed in existing biological opinions or ESA 4(d) Rule determinations (Table 1). NMFS is the lead agency responsible for administering the Marine Mammal Protection Act of 1972 (MMPA) as it relates to certain marine mammals.

Leatherback sea turtles (*Dermochelys coriacea*), steller sea lions (*Eumetopias jubatus*) and humpback whales (*Megaptera novaeangliae*) are also listed under the ESA under NMFS' jurisdiction, and these species may occur in Puget Sound (NMFS 2004d). Leatherback sea turtle use of inland Washington waters is accidental at best; and therefore, this species is unlikely to interact with Puget Sound salmon fisheries (NMFS 2004a; personal communication with B. Norberg, NMFS, May 6, 2004). NMFS has concluded that Puget Sound troll, purse seine, reef net, beach seine and recreational salmon fisheries would result in a remote likelihood or no known serious injuries or mortalities to marine mammals, and that Puget Sound drift gillnet fisheries would result at most in occasional serious injuries and mortalities to marine mammals (68 FR 1414, January 10, 2003). No listed marine mammal or sea turtle species were documented to have been killed or caught and released in the Puget Sound salmon fishery (NMFS 2004a; 68 FR 1414, January 10, 2003). Consequently, because the Puget Sound salmon fishery is not likely to adversely affect listed marine mammal or sea turtle species, they will not be considered further in this biological opinion.

NMFS has identified four criteria to assess the viability of salmon populations: abundance, population productivity trends, spatial distribution, and diversity (McElhany *et al.* 2000). Although all four criteria are important, information and specific thresholds are currently unavailable for the spatial distribution and diversity criteria, and, for most populations, productivity as well, so assessments of the effects of actions on listed salmon generally rely more on abundance. Assessment of abundance takes into account both the trend and magnitude of abundance as compared with two abundance thresholds. The critical escapement threshold generally represents a state where a population is at such low abundance or productivity that it is at relatively high risk of extinction in the near future. At the viable escapement threshold, a population is functioning properly and at a self-sustaining abundance level. Derivation of these thresholds for abundance are based on population-specific information where available. Where data are unavailable, NMFS uses information from the scientific literature to provide 'rules of thumb' for setting either critical or viable escapement thresholds (McElhany *et al.* 2000). In general, if population abundance is less than 500 to 5,000 per generation, there is an increased risk of extinction. If the salmonid population generation length is four years (the approximate generation length for Puget Sound chinook salmon), the annual spawner abundance at the critical level would be in the range of 125 to 1,250 fish. At viable levels, abundance would range from 1,000 to 16,700 fish per generation, or (for fish with a four-year generation length) 250 to 4,175 spawners per year. NMFS used the generic guidance, information from existing scientific literature, and population-specific information, to make preliminary threshold determinations for the Puget Sound Chinook populations considered in this biological opinion.

Survival and recovery will depend, over the long term, on actions in all sectors, especially habitat actions. There is an ongoing recovery planning effort for the Puget Sound Chinook salmon ESU that includes consideration of all sectors. Completion of the recovery plan and decisions regarding the form and timing of recovery efforts described in the recovery plan will determine the kinds of harvest actions that may be

necessary and appropriate in the future. Absent that guidance, NMFS must evaluate proposed harvest actions by examining the impacts of harvest within the current environmental context. Therefore, future performance of the population is evaluated under current productivity conditions, i.e., assuming that the impact of hatchery and habitat management actions remain as they are now.

Table 2. Summary of U.S. West Coast salmon species listed under the Endangered Species Act.

Species	Evolutionarily Significant Unit	Present	Federal Register Notice
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter-run	Endangered	54 FR 32085 8/1/89
	Snake River Fall-run	Threatened	57 FR 14653 4/22/92
	Snake River Spring/Summer-run	Threatened	57 FR 14653 4/22/92
	Puget Sound	**Threatened**	**64 FR 14308 3/24/99**
	Lower Columbia River	Threatened	64 FR 14308 3/24/99
	Upper Willamette River	Threatened	64 FR 14308 3/24/99
	Upper Columbia River Spring-run	Endangered	64 FR 14308 3/24/99
	Central Valley Spring-run	Threatened	64 FR 50394 9/16/99
	California Coastal	Threatened	64 FR 50394 9/16/99
Chum Salmon (*O. keta*)	Hood Canal Summer-Run	Threatened	64 FR 14570 3/25/99
	Columbia River	Threatened	64 FR 14570 3/25/99
Coho Salmon (*O. kisutch*)	Central California Coast	Threatened	61 FR 56138 10/31/96
	S. Oregon/ N. California Coast	Threatened	62 FR 24588 5/6/97
	Oregon Coast	Threatened	63 FR 42587 8/10/98
Sockeye Salmon (*O. nerka*)	Snake River	Endangered	56 FR 58619 11/20/91
	Ozette Lake	Threatened	64 FR 14528 3/25/99
Steelhead (*O. mykiss*)	Southern California	Endangered	62 FR 43937 8/18/97
	South-Central California Coast	Threatened	62 FR 43937 8/18/97
	Central California Coast	Threatened	62 FR 43937 8/18/97
	Northern California	Threatened	65 FR 6960 2/11/00
	Upper Columbia River	Endangered	62 FR 43937 8/18/97
	Snake River Basin	Threatened	62 FR 43937 8/18/97
	Lower Columbia River	Threatened	63 FR 13347 3/19/98
	California Central Valley	Threatened	63 FR 13347 3/19/98
	Upper Willamette River	Threatened	64 FR 14517 3/25/99
	Middle Columbia River	Threatened	64 FR 14517 3/25/99

3.2.1 Species Description

This section first provides a general life history overview, followed by more specific information about the Puget Sound Chinook Salmon ESU, including information regarding the distribution, population structure, and magnitude, variability, and trends in abundance of the populations within the ESU.

Chinook salmon have the largest body size of any Pacific salmon species. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, Chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, Chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986) described 16 age categories for Chinook salmon, seven total ages with three possible freshwater ages. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" Chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of Chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of Chinook salmon populations. For the purposes of this biological opinion, those Chinook salmon (spring and summer runs) that spawn upriver from the Cascade crest are generally "stream-type"; those which spawn down river of the Cascade Crest (including in the Willamette River) are generally "ocean-type."

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Juvenile rearing in freshwater can be minimal or extended. Additionally, some male Chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Chinook salmon may spend one to six years in the ocean before returning to their natal streams to spawn. Salmon exhibit a high degree of variability in life-history traits; however, there is considerable debate as to what degree this variability is the result of local adaptation or the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of Chinook salmon life history can be found in Myers *et al.* (1998) and Healey (1991).

The Puget Sound Chinook Salmon ESU was listed under the ESA as threatened in March, 1999 (64 FR 14308). It includes all runs of Chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula (Figure 1). Chinook hatchery populations propagating Chinook native to the North Fork Nooksack River, North Fork Stillaguamish River, White River, Dungeness River, and the Elwha River were considered essential for the recovery of the ESU and are listed. Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run Chinook salmon populations in the Puget Sound Chinook ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound populations all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns.

NMFS is currently delineating the population structure of this and other ESUs as an initial step in the aforementioned formal recovery planning process that is now underway. At this time, the Puget Sound

Technical Recovery Team (PSTRT), in cooperation with the co-managers, has completed a preliminary analysis to identify populations of Chinook salmon within the Puget Sound Chinook salmon ESU, identifying 22 demographically independent populations within the ESU, representing the primary historical spawning areas of Chinook salmon (PSTRT 2004a)(Figure 1). The PSTRT reviewed several sources of information in deriving the preliminarily recognized delineations. These sources of information include geography, migration rates, genetic attributes, patterns of life history and phenotypic characteristics, population dynamics, and, environmental and habitat characteristics of potential populations. The annual escapement of populations within the ESU since 1990 is provided in Table 5. Detailed information on each of the populations can be found in *Independent Populations of Chinook in Puget Sound* (PSTRT 2004a) and the *Salmon and Steelhead Stock Inventory* (WDF *et al.* 1993).

Overall abundance of Chinook salmon in this ESU has declined substantially from historical levels, and several populations are small enough that genetic and demographic risks are likely to be relatively high. In its 1998 status review, NMFS noted that the average potential run size (hatchery + natural) at that time was approximately 240,000 with natural spawning escapement averaging 25,000 (Myers *et al.* 1998). Since 1998, natural spawning escapement has averaged approximately 37,000 with increases in the spring, summer, and fall components (Figure 2). The long- and short-term escapement trends for natural Chinook salmon runs in North Puget Sound were predominately negative through the mid-1990s when the North Fork Nooksack, Stillaguamish and Snohomish systems began to show improvements in escapements. In South Puget Sound and Hood Canal, both long- and short-term trends in escapements are predominantly positive. However, the contribution of hatchery fish to natural escapements in these regions may be substantial, masking the trends in natural production.

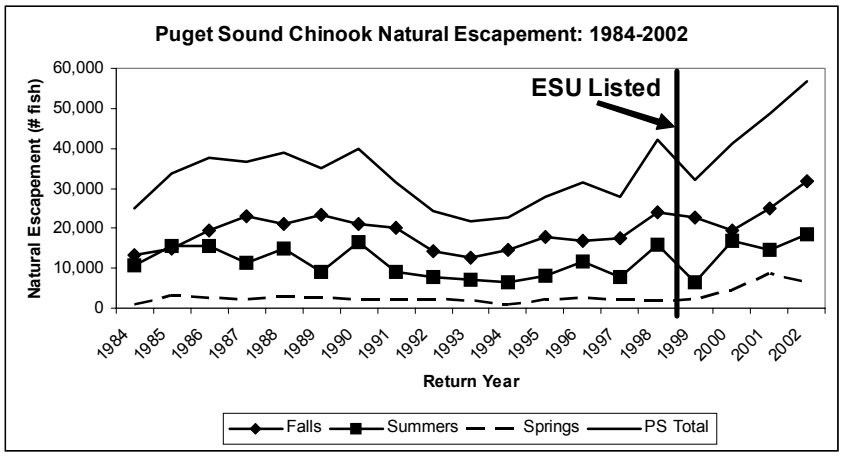


Figure 2. Trends in Puget Sound Chinook natural escapement.

Increased escapements observed in recent years may be the result of improved ocean survival and evolving harvest management strategies implemented since the mid-1990s. Overall, exploitation rates on Puget Sound spring and summer/fall Chinook salmon have declined by 59 percent and 47 percent, respectively, since the early 1980s, with most of the decrease occurring after 1992 (Figure 3).

The status of Puget Sound Chinook salmon populations ranges from healthy to critical depending largely on the status of the habitat. Puget Sound includes areas where the habitat still supports self-sustaining natural production of Chinook, areas where habitat for natural production has been irrevocably lost, and

areas where Chinook salmon were never self-sustaining. In some areas indigenous populations persist, whereas populations in other areas are a composite of indigenous stocks and introduced hatchery fish that may or may not be of local origin. In some areas where natural production has been lost, hatchery production has been used to mitigate for lost natural production. To help characterize the diversity of Chinook populations in Puget Sound, NMFS stratified the populations into five geographic regions and three life history types (spring, summer and fall). To help further describe the varied circumstances of populations in the ESU, Puget Sound populations have also been categorized based on the quality of the watershed habitat and the genetic integrity of the population (described below).

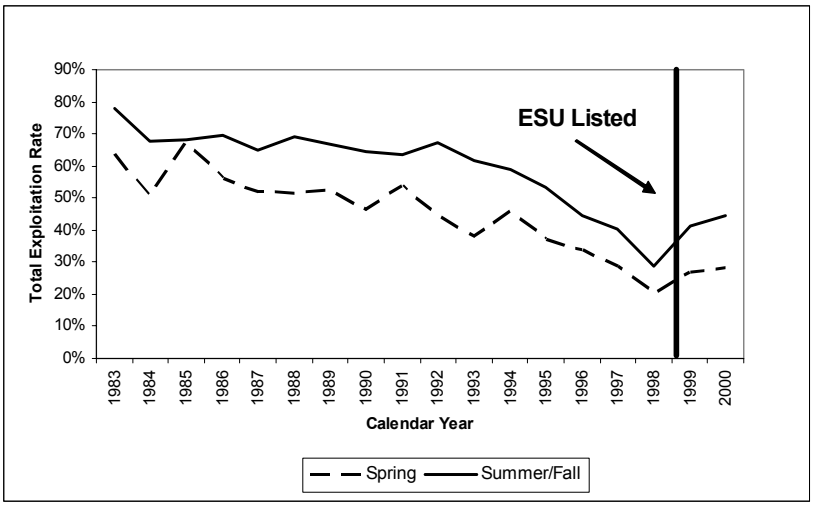


Figure 3. Total exploitation rate trend for Puget Sound Chinook

Category 1 populations are genetically unique and indigenous to watersheds of Puget Sound. Seventeen populations have been identified in this category (Figure 1, Table 3). Although hatchery and natural production is heavily integrated for some of these populations (Elwha, Dungeness, North Fork Nooksack, North Fork Stillaguamish, White, Duwamish-Green) genetic analysis indicates the indigenous genetic profile remains intact. In making its decisions on harvest actions, NMFS' objective for Category 1 populations is to protect and recover these indigenous populations.

Category 2 populations are located in watersheds where indigenous populations may no longer exist, but where sustainable populations existed in the past and where the habitat could still support such populations. These are primarily areas in Hood Canal and South Sound where hatchery production has been used to mitigate for natural production lost to habitat degradation. Consequently, these areas have been managed primarily for hatchery production for many years. Broodstock for the hatchery programs often came from areas outside these watersheds, most commonly the Green River. Natural spawning in these systems continues, but is primarily the result of hatchery-origin strays. Over time, the combination of low natural production and the heavy influence of the out of basin hatchery production is believed to have resulted in the loss of the indigenous stock. Five populations have been identified in this category (Figure 1, Table 3). In making its decisions on harvest actions, NMFS' objective for Category 2 populations is to use the most locally-adapted population to re-establish naturally-sustainable populations, and preserve options for alternatives that may be developed through recovery planning.

The co-managers identified a third population category. Category 3 populations are generally found in small independent tributaries of Puget Sound that may now have some spawning, but never had independent, self-sustaining populations of Chinook salmon. Many of these watersheds do not have the morphological characteristics needed for Chinook and may be better suited for coho and chum salmon, cutthroat trout or resident freshwater species. Chinook salmon that are observed occasionally in these

watersheds are primarily the result of hatchery strays since there is presumably little natural production. The PSTRT did not recognize populations identified as Category 3 because they were not determined to be independently spawning aggregations that would persist 100 years or more and thus, by PSTRT definition, are not populations (PSTRT 2004a). In making its decisions on harvest actions, NMFS' objective for Category 3 is directed toward protection of other species, but no specific harvest actions are proposed to promote the natural production of Chinook salmon. Therefore, NMFS' consideration of Category 3 populations is not discussed further in this biological opinion.

An ESU with well-distributed viable populations avoids the situation where populations succumb to the same catastrophic risk(s), allows for a greater potential source of diverse populations for recovery in a variety of environments (i.e., greater options for recovery), and will increase the likelihood of the ESU's survival in response to rapid environmental changes, such as a major earthquake. Geographically diverse populations in different regions also distribute the ecological and ecosystem services provided by salmon across the ESU. The PSTRT recommends that an ESU-wide recovery scenario should include at least two to four viable Chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 2002). An ESU-wide recovery scenario should also include within each of these geographic regions one or more viable populations from each major genetic and life history group historically present within that geographic region (PSTRT 2002).

Based on this framework, in each geographic region, Category 1 populations are the core populations that provide the focus for the analysis of proposed harvest actions. Consideration of harvest management impacts on Category 2 populations are more important in regions that are not adequately represented by Category 1 populations in order to make sure the proposed harvest actions are adequately protective of the geographic distribution (regions) and life history strategies represented in the ESU. In the future, Category 2 populations may require changes in the management objectives. For example, an outcome of recovery planning may be a recommendation that the population be managed as a self-sustaining natural run. It is important that current management not preclude future options.

Because of the complexity of the ESU, NMFS uses the geographic regions, life history types, and watershed categories described in Table 3 to assess whether the proposed harvest action adequately protects the diversity of populations within the ESU. The critical and viable escapement thresholds against which NMFS assesses status are noted in Table 4.

Table 3. Puget Sound Chinook populations stratified by geographic region, major life history type, and watershed category (NMFS 2001a, PSTRT 2002; PSTRT 2004a).

Geographic Region	Major Life History	Watershed Category[1]	Population
(1) Strait of Georgia	spring	1 1	North Fork Nooksack South Fork Nooksack
(2) Whidbey/Main Basin	spring	1 1 1	Upper Cascade Upper Sauk Suiattle
	fall summer summer summer fall	1 1 1 1 1	Lower Skagit Upper Skagit Lower Sauk North Fork Stillaguamish South Fork Stillaguamish
	summer/fall	1 1	Skykomish Snoqualmie
(3) Southern Basin	fall	2 1 1 2 2	Sammamish Cedar Green Puyallup Nisqually
	spring	1	White
(4) Hood Canal	fall	2 2	Skokomish Mid-Hood Canal Rivers
(5) Strait of Juan de Fuca	fall	1	Elwha
	spring	1	Dungeness

[1] Category 1 watersheds contain populations that are genetically unique and indigenous to Puget Sound. Category 2 populations are located in watersheds where indigenous populations may no longer exist, but where sustainable populations existed in the past and where the habitat could still support such populations.

Table 4. Recent average annual escapement levels compared with NMFS-derived critical and viable thresholds for Puget Sound Chinook salmon management units and individual populations.

Management Unit	Population	1990 to 1998 Average Escapement	1999 to 2002 Average Escapement	Abundance Thresholds Critical[1]	Abundance Thresholds Viable[2]	Trend since listing[3]	% change[4]
Nooksack	Natural-Origin Spawner:	297	429	*400*	*500*		
	North Fork Nooksack	144	180	*200*	-	Increasing	25%
	South Fork Nooksack	153	249	*200*	-	Increasing	63%
Skagit Summer/Fall	Natural Spawners:	8,698	13,810	-	-		
	Upper Skagit River	6,676	10,144	*967*	*7,454*	Increasing	52%
	Lower Sauk River	539	721	*200*	*681*	Increasing	34%
	Lower Skagit River	1,484	2,944	*251*	*2,182*	Increasing	98%
Skagit Spring	Natural Spawners:	1,014	1,075				
	Upper Sauk River	392	364	*130*	*330*	Stable	-7%
	Suiattle River	398	380	*170*	*400*	Stable	-5%
	Upper Cascade River	224	330	*170*	-	Increasing	47%
Stillaguamish	Natural-Origin Spawners:	828	980				
	N.F. Stillaguamish River	557	697	*300*	*552*	Increasing	25%
	S.F. Stillaguamish River	271	283	*200*	*300*	Stable	5%
Snohomish	Natural-Origin Spawners:	2,627	3,936				
	Skykomish River	1,625	2,118	*1,650*	*3,500*	Increasing	30%
	Snoqualmie River	1,003	1,818	*400*	-	Increasing	81%
Lake Washington	Natural Spawners:	624	767				
	Cedar River	417	385	*200*	*1,250*	Stable	-8%
	Sammamish River	208	373	*200*	*1,250*	Increasing	79%
Duwamish-Green River	Natural Spawners: Duwamish-Green River	6,737	9,299	*835*	*5,523*	Increasing	38%
White River	Natural Spawners: White River	403	1,220	*200*	*1,000*	Increasing	203%
Puyallup	Natural Spawners:						
	Puyallup River	2,173	1,672	*200*	*1,200*		
	South Prairie Cr. Index	1,032	1,029			Stable	0%
Nisqually	Natural Spawners: Nisqually River	893	1,318	*200*	*1,100*	Increasing	48%
Skokomish	Natural Spawners: Skokomish River	981	1,503	*200*	*1,250*	Increasing	53%
Mid-Hood Canal	Natural Spawners: Mid-Hood Canal Rivers	178	404	200	*1,250*	Increasing	127%
Dungeness	Natural Spawners: Dungeness River	138	345	*200*	*925*	Increasing	150%
Elwha	Natural Spawners: Elwha River	1,994	2,009	*200*	*2,900*	Stable	1%

[1] Critical threshold under current habitat and environmental conditions.

[2]Viable thresholds under current habitat and environmental conditions.

[3]Population trend was considered increasing if the 1999-2002 average escapement was 10% or greater than the 1990-1998 average escapement; decreasing if the 1999-2002 average escapement was 10% or less than the 1990-1998 average escapement; and stable if the 1999-2002 average escapement was within 10% of the 1990-1998 average escapement.

[4]The percent change in the post-listing 1999-2002 average escapement when compared to the pre-listing 1990-1998 average escapement.

Table 5. Natural-origin or natural escapement for Puget Sound Chinook salmon populations, 1990 to 2002.

Management Unit	Population	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Nooksack	Natural-Origin Spawner:	142	444	403	444	113	421	353	223	128	255	442	517	503
	North Fork Nooksack	6	87	345	285	26	175	210	121	39	91	159	250	221
	South Fork Nooksack	136	357	58	159	87	246	143	102	89	164	283	267	282
Skagit	Natural Spawners:	16,792	5,824	7,348	5,801	5,549	6,877	10,613	4,872	14,609	4,924	16,930	13,793	19,591
Summer/Fall	Upper Skagit River [1]	11,793	3,656	5,548	4,654	4,565	5,948	7,989	4,168	11,761	3,586	13,092	10,084	13,815
	Lower Sauk River [1]	1,294	658	469	205	100	263	1,103	295	460	295	576	1,103	910
	Lower Skagit River [1]	3,705	1,510	1,331	942	884	666	1,521	409	2,388	1,043	3,262	2,606	4,866
Skagit	Natural Spawners:	1,511	1,346	986	783	470	855	1,051	1,041	1,086	471	906	1,856	1,065
Spring	Upper Sauk River [1]	557	747	580	323	130	190	408	305	290	180	273	543	460
	Suiattle River [1]	685	464	201	292	167	440	435	428	473	208	360	688	265
	Upper Cascade River [1]	269	135	205	168	173	225	208	308	323	83	273	625	340
Stillaguamish	Natural-Origin Spawners:	701	1,279	716	725	743	654	935	839	863	767	1,127	936	1,090
	N.F. Stillaguamish River	434	978	422	380	456	431	684	613	615	514	884	653	737
	S.F. Stillaguamish River	267	301	294	345	287	223	251	226	248	253	243	283	353
Snohomish	Natural-Origin Spawners:	3,662	2,447	2,242	3,190	2,039	1,252	2,379	3,517	2,919	2,430	2,900	5,869	4,544
	Skykomish River	2,551	1,951	1,642	942	1,478	1,144	1,719	1,696	1,500	1,382	1,773	3,052	2,264
	Snoqualmie River	1,111	496	600	2,248	561	108	660	1,821	1,419	1,048	1,127	2,817	2,280
Lake Washington	Natural Spawners:	787	661	790	245	888	930	336	294	697	778	347	1,269	637
	Cedar River [1, 2]	469	508	525	156	452	681	303	227	432	241	120	810	369
	Sammamish River [3]	318	153	265	89	436	249	33	67	265	537	227	459	268
Green River	Natural Spawners:													
	Duwamish-Green River	7,035	10,548	5,267	2,476	4,078	7,939	6,026	9,967	7,300 [6]	9,100 [6]	6,170	7,975	13,950
White River	Natural Spawners:													
	White River	275	194	406	409	392	605	628	402	316	553	1,523	2,002	803
Puyallup	Natural Spawners:													
	Puyallup River [4]	3,515	1,702	3,034	1,999	1,328	2,344	2,111	1,110	1,711	1,988	1,193	1,915	1,590
	S. Prairie Creek Index Area [4]	-	-		-	798	1,408	1,268	667	1,028	1,430	695	1,154	840
Nisqually	Natural Spawners:													
	Nisqually River	994	953	106	1,655	1,730	817	606	340	834	1,399	1,253	1,079	1,542
Skokomish	Natural Spawners:													
	Skokomish River	642	1,719	825	960	657	1,398	995	452	1,177 [6]	1,692 [6]	926 [6]	1,913 [6]	1,479
Mid-Hood Canal	Natural Spawners													
	Mid-Hood Canal Tributaries:	-	86	96	112	384	103	-	-	287	762	438	322	95
Dungeness	Natural Spawners:													
	Dungeness River	310	163	158	43	65	163	183	50	110	75	218	453	633
Elwha	Natural Spawners:													
	Elwha River [6,]	2,956	3,361	1,222	1,562	1,216	1,150	1,608	2,517	2,358	1,602	1,851	2,208	2,376
ESU Total		39,964	29,240	26,284	19,457	20,887	25,610	27,773	26,380	36,238	27,326	36,087	43,341	52,744

[1] The majority are natural-origin spawner.

[2] The escapement estimates for the Cedar River are based on an expansion of a live count of fish. However, Cedar River redd counts suggests that this expansion

of the live count may be a conservative estimate of the total escapement (P. Hage, Muckleshoot Tribe, e-mail to S. Bishop, NMFS, February 10, 2004).

[3] Does not include escapement into the Upper Cottage Lake Creek, which has been surveyed since 1998. Surveys of the Upper Cottage Lake Creek have exceeded 100 fish (S. Foley, WDFW, pers. com., to K. Schultz, NMFS, February 19, 2004). Escapement counts also do not include spawners in Issaquah Creek, which are believed to be primarily Issaquah Hatchery returns (N. Sands, NMFS, e-mail to S. Bishop, NMFS, February 26, 2004). Therefore, escapement information presented is a conservative estimate of the total Sammamish River population's escapement.

[4] The area surveyed for the South Prairie Creek index increased from 1.5 to 12.5 stream miles in 1994.

[5] Escapement is considered in-river gross escapement plus hatchery voluntary escapement minus pre-spawning mortality.

Following is a brief description of the status of populations in each geographic region.

The two spring Chinook populations in the **Strait of Georgia Region** are the North Fork Nooksack and the South Fork Nooksack Rivers (Figure 1). Both are watershed Category 1 populations. The two populations are genetically distinct from each other because of prevailing habitat conditions. One is strongly influenced by glacial flow; the other is not. Habitat conditions in both areas are substantially degraded due largely to timber harvest and associated road building activities. Straying between the two populations was historically low, as supported by available genetic data, but straying may have increased in recent years (PSTRT 2004a). The more recent straying observations may be partially due to an increase in hatchery production. This potential source of straying may have been reduced by the co-managers with the implementation of a 50 percent reduction in on-station hatchery releases from Kendall Creek Hatchery (T. Scott, WDFW, e-mail to K. Schultz, NMFS, March 22, 2004).

Escapement to the North Fork Nooksack River was below 500 fish in all but two years from 1984 through 1998. However, escapement has increased in recent years, averaging 180 natural origin spawners (3,438 total natural spawners[1]) since 1999 (Tables 5 and 6). The increase in total naturally spawning escapement in recent years has been primarily due to large returns from a hatchery supplementation program. The annual spawning escapement to the South Fork ranged from 103 to 620 fish between 1984 and 2002, and the escapements have increased over pre-listing levels (Table 4). Escapement from 1999 through 2002 averaged 249 natural origin spawners (338 total natural spawners) (Table 5).

Production from Kendall Creek Hatchery contributes extensively to the annual return abundance of the North Fork Nooksack River population. If escapement of the hatchery-origin fish to the natural spawning grounds is considered, the 1999 to 2002 four-year average spawning escapement is 3,438 fish for the North Fork Nooksack River (Table 6). When compared to hatchery-origin returns, the lack of a similar dramatic increasing escapement trend in natural-origin fish, even in response to past harvest rate reductions, suggests constraints on productivity due to limitations in marine, estuarine or freshwater habitat.

Table 6. Natural-origin and natural spawners, North Fork Nooksack River, 1999 to 2002.

Management Unit	North Fork Nooksack River Population	1999	2000	2001	2002	1999 to 2002 Average
	Natural-Origin Spawners:	91	159	250	221	180
Nooksack	Natural Spawners [1]	911	1,365	4,057	7,419	3,438

[1] Natural spawners include first generation hatchery-origin adults that spawn in natural spawning areas.

A conservation-based supplementation program was initiated on the North Fork in 1986 using indigenous broodstock to help rebuild the North Fork Nooksack spring Chinook population. Hatchery fish from the supplementation program were included in the ESA listing because they were considered essential for recovery. Between 1992 and 2002, hatchery-origin adults accounted for an estimated 67 percent of naturally-spawning Chinook in the North Fork (PSTRT 2003a). There is no comparable supplementation program on the South Fork Nooksack. The Kendall Creek Hatchery stock retains the genetic

[1]Natural origin spawners are those whose parents spawned in the wild. Natural escapement also includes adults produced from hatcheries and stray to the spawning grounds.

characteristics of the wild population. Additionally, the co-managers are applying operational techniques that decrease the likelihood for divergence of the hatchery population from the extant natural population. Therefore, adult fish production resulting from the Kendall Creek Hatchery program help to buffer the genetic and demographic risks to the North Fork Nooksack River population.

The **Whidbey/Main Basin Region** includes the Skagit, Stillaguamish and Snohomish river systems (Figure 1, Table 3). The three basins contain 10 Chinook populations (PSTRT 2004a) which are all watershed Category 1 populations. These watersheds are hydrologically diverse, differ in the magnitude of hatchery production, and support populations with different life history strategies, including three of Puget Sound's seven spring Chinook runs and three of its five summer-run populations.

The Skagit River system contains six of the ten populations in the region including three spring, two summer; and a fall-timed population (PSTRT 2004a). Escapements generally declined steadily from the 1970s to the mid-1990s. However, the most recent four year period has shown increasing trends in escapement for four of the six populations and stable trends for the other two populations. The populations vary significantly in abundance and productivity. Escapement for the Lower Skagit fall, Lower Sauk summer and Upper Skagit summer populations averaged 2,944, 721, and 10,144, respectively, from 1999 through 2002 which exceeded their viable thresholds of 2,182, 681 and 7,454 (Table 4). The three Skagit spring Chinook populations are smaller, but comparable to each other in terms of abundance. Escapement for the Upper Cascade, Upper Sauk, and Suiattle spring populations averaged 330, 364, and 380, respectively, from 1999 through 2002 compared with viable thresholds of 330 and 400 for the Upper Sauk and Suiattle populations[2], respectively (Table 4). Average productivity[3] for the 1990-97 brood years ranged from 1.6 to 3.9 recruits/spawner for the six Skagit Chinook populations (PSTRT 2003b; PSTRT 2003c).

The Skagit Chinook populations are relatively unaffected by hatchery production. There is a small production facility on the Cascade River that serves primarily as an indicator stock for the coded-wire tag program to monitor survival rates, exploitation rates and harvest distribution. The contribution of hatchery-origin fish to natural spawning has been estimated at less than 2 percent (PSTRT 2003b; PSTRT 2003c).

The Stillaguamish River includes two populations. Escapements to the North Fork Stillaquamish declined from 1974 through 1991. Since then, there has been an increasing trend. The estimated average annual escapement from 1999 through 2002 was 697 natural-origin spawners (1,151 natural spawners) in the North Fork compared to critical and viable escapement thresholds of 300 and 552 (Table 4). There has been no significant trend in escapement in the South Fork Stillaguamish River which has averaged 283 spawners since 1999 compared to critical and viable escapement thresholds of 200 and 300, respectively (Table 4).

A conservation-based supplementation program was initiated on the North Fork Stillaguamish in 1986 using indigenous broodstock to help rebuild the population. Hatchery fish from the supplementation program were included in the ESA listing because they were considered essential for recovery. Hatchery-

[2]Data was unavailable to derive a viable threshold for the Upper Cascade population.

[3]The number of adult recruits produced per parent spawner.

origin adults comprised 33 percent of natural spawners in the North Fork from 1990 through 2002. (PSTRT 2003d) There is no comparable program on the South Fork Stillaguamish. Straying of hatchery fish in the South Fork has not been quantified.

Two Chinook salmon populations have been identified in the Snohomish River system: the Skykomish and Snoqualmie. The Skykomish population includes both summer and fall-timed fish (PSTRT 2004a). Spawning escapement to the Skykomish River showed a marked declining trend from the late 1970s until 1993, and a substantial increasing trend since then. The average escapement from 1999 through 2002 was 2,118 natural-origin spawners (4,226 total naturally spawning adults) compared to critical and viable escapement thresholds of 1,650 and 3,500 (Table 4) natural-origin adults. The trend in escapement for the Snoqualmie River population was relatively flat from the late 1970s to the mid-1990s. From 1999 through 2002, the average annual escapement was 1,660 natural-origin adults (2,113 total natural) compared to a critical escapement threshold of 400 natural-origin adults (Table 4). A viable escapement threshold has not been identified. Productivity has averaged 1.5 and 2.5 recruits/spawner for the Skykomish and Snoqualmie populations, respectively for the 1994-1997 brood years (1996-2002 return years)(PSTRT 2003e; PSTRT 2004b).

The primary objective of the hatchery program on the Snohomish system is fishery augmentation although it does rely on local-origin broodstock. From 1990 through 2002, an estimated 42 percent of naturally-spawning Chinook in the Skykomish River and 23 percent of naturally-spawning Chinook in the Snoqualmie River were of hatchery origin (PSTRT 2003e; PSTRT 2004b).

The **Southern Basin region** contains four major Chinook-bearing watersheds: Lake Washington, and the Duwamish-Green, Puyallup and Nisqually Rivers (Figure 1, Table 3). The PSTRT identified six populations in the region (PSTRT 2004a). Three of the populations are designated watershed Category 1 and three Category 2. Genetically, most of the present spawning aggregations in the South Puget Sound Region are similar, likely reflecting the extensive influence of transplanted stock hatchery releases, primarily from the Duwamish-Green River population (PSTRT 2004a). Most Chinook salmon in the South Puget Sound Region also have similar life history traits. Accordingly, the PSTRT found that life history and genetic variations were not useful in determining independent populations within the South Puget Sound Region. The lower reaches of all these system flow through lowland areas that have been developed for agricultural, residential, urban or industrial use. Natural production is limited by stream flows, physical barriers, poor water quality and limited spawning and rearing habitat related to timber harvest and residential, industrial and commercial development.

Long and short term trends in escapement for populations in the South Basin region have generally been positive. However, the magnitude of hatchery fish on the spawning grounds is likely masking the true level of natural production (Myers *et al.* 1998; PSIT/WDFW 2003; WCBRT 2003). Except for the Cedar and Sammamish Chinook populations, escapements in the other areas have exceeded their viable escapement thresholds in recent years (Tables 4 and 7).The range of escapements in the former two populations include years in which escapements have come close to or have fallen below their critical escapement thresholds. However, in the case of the Cedar River population, recent comparisons of escapement estimation methods indicate more spawners may be present than previously thought. In the case of the Sammamish population, escapement estimates do not include escapement into some of the tributary areas. Therefore, a direct comparison of escapements with the VSP generic guidance of a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

Numerous hatcheries in this area account for the majority of Chinook salmon produced in Puget Sound (PSMFC 2002). With the exception of the White River program, the purpose of hatchery production in the region is primarily for fishery augmentation. Until recently, inter-basin transfers of Chinook between hatcheries were common and extensive, with the Green River stock propagated at the WDFW Soos Creek Hatchery serving as the primary source for broodstock. Because of the magnitude and duration of these programs and the low natural production in these systems, particularly in the Nisqually and Puyallup Rivers, there is no detectable genetic difference between the fish originating from the hatcheries and those spawned in the wild (PSIT/WDFW 2003; WDF *et al.* 1993 as cited in PSTRT 2004a). Under a policy adopted by the co-managers in 1991, all Puget Sound hatchery programs established using Green River stock were required to become self-sustaining, and transports of Green River-origin broodstock between watersheds were prohibited. Although stray rates have not been quantified for most areas, hatchery fish are believed to contribute heavily to the naturally spawning populations. For example, stray rates in the Green River averaged 72 percent from 1990 through 2002 (PSTRT 2003f). However, because the hatchery program on the Green River has not received out-of-basin stock transfers, the integrated Green River natural/hatchery-origin stock likely retains most of is genetic characteristics (Marshall *unpublished*) and is thus classified as a Category 1 population. The White River supports the only spring Chinook population in the South Sound Region and is also classified as Category 1. Because of chronically low abundance, a conservation-based hatchery program was initiated in the mid-1970s to help rebuild White River spring Chinook salmon. NMFS has included the program in the ESA listing because it is considered essential for recovery.

Table 7. Recent year natural escapement for populations in the Southern Basin Region

Population	1999-2002 Average Escapement (range)	Thresholds		Average Exploitation Rates	
		Critical	Viable	1983-1988	1999-2003
Sammamish	373 (227-537)	200	1,250	78%[1]	29%[1]
Cedar	385 (120 - 810)	200	1,250	78%[1]	29%[1]
Duwamish-Green	9,299 (6,170 - 13,950)	835	5,500	79%[2]	44%[2]
Puyallup	1,672 (1,193 - 1,988)	200	1,200	75%[1]	59%[1]
White	1,220 (553 - 2,002)	200	1,000	77%[2]	39%[2]
Nisqually	1,318 (1,079 - 1,542)	200	1,100	90%[2]	77%[2]

Data source: [1]FRAM 2003
[2]CTC 2003. Data are through 2000. Data for years for years 2001-2003 are not yet available.

The **Hood Canal Region** has two fall Chinook salmon populations, one in the Skokomish River, and a second that comprises three Hood Canal rivers (Dosewallips, Duckabush and Hamma Hamma Rivers)(PSTRT 2004a). Both the Skokomish and Mid-Hood Canal Rivers populations are considered watershed Category 2 populations and thus are a composite of natural- and hatchery-origin fish that are genetically indistinguishable. Historically, the Skokomish River supported the largest natural Chinook

run in Hood Canal. Natural production in the North Fork Skokomish has been limited as a result of impacts associated with a hydroelectric dam that blocks anadromous passage at RM 21 and greatly limited in-stream flow due to an out of basin diversion. Natural production in the South Fork is further limited by the effects of intensive logging activity (WDF *et al.* 1993). Natural escapements to the Skokomish have increased from a pre-listing average (1990-1998) of 981 to a 1999-2002 average escapement of 1,503 total natural spawners. These averages compare to critical and viable escapement thresholds of 200 and 1,250, respectively (Table 4).

The Mid-Hood Canal Rivers population is the other independent Chinook salmon population within Hood Canal (PSTRT 2004a). A great deal of uncertainty remains about the relationship among the Chinook in the three rivers because of the lack of information about the populations prior to significant habitat alteration and use of hatchery supplementation in these rivers. The largest uncertainty within the Hood Canal populations, as identified by the TRT, is the degree to which chinook salmon spawning aggregations are demographically linked in the Hamma Hamma, Duckabush, and the Dosewallips Rivers. A possible alternative scenario, as identified by the TRT, is that the chinook salmon in the Hamma Hamma, Duckabush, and Dosewallips were independent populations (PSTRT 2004a). Habitat differences do exist between these Mid-Hood Canal tributaries. The Dosewallips River is the only system in the snowmelt-transition hydroregion (PSTRT 2004a). Prior to 1986, all escapement estimates for these rivers were made by extrapolation based on observations from the Skokomish River (PSIT/WDFW 2003).

Aggregate escapement to the three mid-Hood Canal rivers has averaged 404 since 1999 (Table 4), compared with VSP critical and viable escapement thresholds of 200 and 1,250, respectively. The spatial structure of the Mid-Hood Canal Rivers population is unique in that the three sub-populations (Hamma Hamma, Dosewallips and Duckabush rivers) are separated by salt water. The 1999-2002 average escapements into these individual sub-populations range from 43 to 304 spawning adults.

The primary purpose of the hatchery program in the Skokomish River is fishery augmentation. The brood source is of mixed origin, with significant influence from historical transplants from South Puget Sound facilities. The contribution of hatchery straying to natural spawning is unknown but believed to be substantial (PSIT/WDFW 2004; PSTRT 2004a). A Chinook supplementation program contributes to escapement on the Hamma Hamma River and straying from other hatchery programs within Hood Canal presumably occurs (personal communication with W. Beattie, NWIFC, January 31, 2004).

The **Strait of Juan de Fuca Region** has two watershed Category 1 populations including a native, spring-timed population on the Dungeness, and a native, fall-timed population on the Elwha (PSTRT 2004a). The Dungeness population is considered critical due to chronically low spawning escapement levels (WDF *et al.* 1993).

The Dungeness River is located in the rain shadow of the Olympic Mountains and, as a result, receives relatively little rainfall (less than 20 inches per year). The Dungeness is therefore particularly dependent on annual precipitation and snow pack, and is susceptible to habitat degradations that exacerbate low flow conditions. Agricultural water withdrawals remove as much as 60 percent of the natural flow during the critical low flow period which coincides with Chinook salmon spawning. Other land use practices have also substantially degraded the system.

Much of the Elwha River drainage is still pristine and protected in the Olympic National Forest. However, two dams at river miles 4.9 and 13.4 block passage to over 70 miles of potential habitat. The

remaining habitat below the first dam is degraded by the loss of natural gravel, large woody debris, and the adverse effects of high water temperatures. In some years, high temperatures exacerbate problems with the parasite *Dermocystidium* with resulting pre-spawning mortality sometimes as high as 70 percent (WDF *et al.* 1993). Recovery of the Elwha population depends on restoring access to high quality habitat in the upper Elwha basin. The Elwha Dams are scheduled for removal beginning in 2007, thus greatly enhancing the prospects for eventual recovery of a viable Chinook salmon population.

Dungeness escapement has remained mostly below 250 spawners since 1986. The trend in escapement from 1986 to the present has been relatively flat, although there has been a marked increase in escapement since 2000 (Table 5). Escapements averaged 345 from 1999 through 2002 (Table 4) compared with critical and viable escapement thresholds of 200 and 925. Elwha escapements have averaged 2,009 from 1999 through 2002 (Table 4) compared with critical and viable escapement thresholds of 200 and 2,900. Although the long term trend has been downward, escapement levels have been stable since 1992.

Because of the limitations on natural production and low abundance, the co-managers, in cooperation with federal agencies and private-sector conservation groups, implemented hatchery supplementation programs on both the Elwha and Dungeness using endemic broodstocks. Hatchery fish from the supplementation programs were included in the ESA listing because they were considered essential for recovery. Considering the current level of degradation in habitat quality and quantity, the populations would likely have gone extinct without the continued contribution of the hatchery programs. The contribution of hatchery straying to natural spawning is unknown but believed to be substantial (PSMFC 2002; PSTRT 2004a; NMFS 2000b).

3.2.2 Critical Habitat

Critical habitat was designated and described in detail, for the Puget Sound Chinook Salmon ESU on February 16, 2000 (65 FR 7764). On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent decree withdrawing the February 2000 critical habitat designation for these ESUs, along with several others. However, it is useful to note that previous biological opinions (NMFS 2003a; NMFS 2000b) concluded that Puget Sound salmon fisheries were not likely to adversely affect critical habitat as proposed at that time. Currently, critical habitat is not designated for the Puget Sound Chinook Salmon ESU.

3.3 Environmental Baseline

The environmental baseline is an analysis of the effects of past and present human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02).

The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities having the greatest impact on the environmental baseline generally fall into five categories: hydro-power system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; artificial propagation; harvest impacts and fluctuations in natural conditions. The relative effect of each impact category to the ESUs, and to each stock within an ESU, differs. Habitat restoration actions are expected to improve productivity by restoring

habitat to proper function (NMFS 1996a). However, in most cases, it will be a decade or more before the effects are demonstrable. The harvest standards discussed in this opinion were developed under assumptions of current habitat productivity and capacity. The following discussion reviews recent developments in each of the sectors, and outlines their anticipated impacts on natural conditions and the future performance of the listed ESUs.

3.3.1 Hydro-Power System

While not as overriding an effect on the Puget Sound ESU as a whole when compared with other factors, dams constructed for hydropower generation, irrigation or flood control have substantially affected Chinook populations in several river systems. The construction and operation of dams have blocked access to spawning and rearing habitat, changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel to downstream areas. For example, hydromodification in the Skagit River system has resulted in a loss of 64 percent of its distributary sloughs and 45 percent of side channel sloughs (Bishop and Morgan 1996; PSSRG 1997).

3.3.2 Habitat

Water quality in streams throughout Puget Sound has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest, mining, and urbanization. Within the area encompassed by the Puget Sound Chinook ESU, over 1,300 streams and river segments and lakes do not meet Federally approved, state and Tribal water quality standards and are now listed as water quality limited under Section 303(d) of the Clean Water Act (DOE 2004). Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Highway culverts that are not designed for fish passage can block upstream migration. Migrating fish are also diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. Whereas many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish in some areas.

Land ownership has played a part in habitat and land use changes. While there is substantial habitat degradation across all ownerships, in general, habitat in many Federally managed headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al.* 1993; Frissell 1993; Henjum *et al.* 1994). In the past, valley bottoms were among the most productive fish habitats (NCRT 2001; SBSRTC 1999; Spence *et al.* 1996; Stanford and Ward 1992). Today, agricultural and urban land development and water withdrawals have critically altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation (Bishop and Morgan 1996; NCRT 2001; PSSRG 1997; SBSRTC 1999).

3.3.3 Artificial Propagation

Puget Sound currently includes over 100 hatchery programs and associated satellite facilities, some of which were initiated more than 100 years ago, and well before the salmon and steelhead were listed pursuant to the ESA (NMFS 1999a). Hatcheries in the Pacific Northwest have been used to mitigate for

declines in salmon and steelhead abundance. Today, hatchery fish contribute to varying degrees to naturally spawning salmon populations in Puget Sound (see Status discussion above).

Hatchery programs have generally been put in place to mitigate for declines in fish runs due to habitat destruction from hydropower construction, human development, resource extraction, and overfishing. Much of the hatchery production is for fishery augmentation, but hatcheries are increasingly important for conserving natural populations in areas where the habitat can no longer support natural production or where the numbers of returning adults are so low that intervention is required to reduce the immediate risk of extinction. Over the last decade, there has been a greater focus on the use of hatcheries to restore, maintain and conserve natural populations of anadromous salmonids as well (NMFS 2001d; NMFS 2003b; WDFW *et al.* 1996; WDFW/PNPT 2000).

Hatchery programs producing non-listed salmonid species are being used to benefit the fisheries that are under review in this opinion. Many of the artificial propagation programs are designed to provide surplus fish for harvest in commercial, tribal, and recreational fisheries. These non-listed fish production programs are also used to meet international harvest objectives set forth under the Pacific Salmon Treaty agreement, and to mitigate for natural salmonid production losses due to habitat blockage and degradation.

Potential negative effects of artificial propagation on naturally produced populations include effects on the genetic and ecological health of natural populations, effects of fisheries management and the potential to mask the status of naturally producing stocks which affects public policy and decision making. NMFS' status reviews of the listed ESUs (Busby *et al.* 1996; Myers *et al.* 1998; Johnson *et al.* 1997; Weitkamp *et al.* 1995) and the recent BRT report (WSCBRT 2003) have identified hatchery effects as potential factors for the decline in these ESUs. In response to ESA listings and regional hatchery reform initiatives, hatchery programs and the associated fishery plans have changed, and state and tribal co-managers have begun to implement mitigation provisions as part of conservation initiatives (WDFW/PNPTT 2000). The intent of hatchery reform is to strive to reduce negative effects of artificial propagation on natural populations while retaining its proven production and potential conservation benefits. For example, hatchery programs are in the process of phasing out use of improper broodstocks, such as out-of-basin or out-of-ESU stocks, replacing them with fish derived from, or more compatible with, locally adapted populations. The basic thrust of many of these reforms has been to produce fish that pose less risk to natural populations, either by minimizing interactions with natural populations or by making hatchery fish more compatible with them. These improvements are needed not only to address artificial propagation's potential negative effects on listed fish but also to improve the overall success of artificial propagation programs.

In addition, fisheries that target hatchery fish may over harvest less productive wild populations. For populations with a substantial hatchery component, fisheries are now managed to provide primary protection to the naturally spawning Chinook while shaping fisheries to maximize access to surplus hatchery production. The majority of Puget Sound Chinook salmon are now mass marked to assess the contribution of hatchery-origin adults on the spawning grounds, improve broodstock management, and allow for selective harvest opportunity where appropriate. Hatcheries in Puget Sound are currently the subject of an ESA review designed to address the adverse effects of ongoing hatchery programs.

Scientific knowledge regarding the benefits and risks of artificial propagation is incomplete, but improving. Artificial propagation measures have proven effective in many cases at alleviating near-term

extinction risks, yet the potential long-term benefits of artificial propagation as a recovery tool are unclear. Scientific uncertainty remains about whether and to what extent hatcheries, as they are currently operated, pose a continuing risk to natural populations. The hatchery operators conduct monitoring and evaluation activities to address these issues and to evaluate the success of artificial propagation programs and the reforms.

3.3.4 Harvest

Puget Sound Chinook salmon are harvested throughout their migratory range from Alaska to Oregon both in fisheries intended to harvest salmon and in fisheries directed on other species. Until recently, exploitation rates on Puget Sound Chinook have been too high for many of the component stocks and have contributed to their decline (Myers *et al.* 1998) particularly because of what we now know about the cycles in ocean productivity (Section 3.3.5).

Salmon are taken incidentally in the Bering Sea/Aleutian Islands, and the Gulf of Alaska groundfish fisheries off of the coast of Alaska. NMFS has conducted section 7 consultations on the impacts of fishing conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fisheries Management Council on ESA listed species and concluded that impacts were not likely to jeopardize listed salmon ESUs, including the Puget Sound Chinook Salmon ESU (NMFS 1994; NMFS 1995; NMFS 1999e, NMFS 2000d). The bycatch in the Canadian groundfish fisheries has been considered in previous consultations on U.S. groundfish and salmon fisheries (NMFS 1992, NMFS 1999d). The conclusion was that the bycatch of listed species was not likely to be a substantial additional impact to that of the U.S., assuming that the total annual salmon bycatch in Canadian groundfish fisheries was approximately 28,000 fish per year[4] (NMFS 1999d).

Salmon are taken incidentally in the groundfish fishery off Washington, Oregon, and California. NMFS conducted section 7 consultations under the ESA pertaining to the effects of the groundfish fishery conducted under the Pacific Coast Groundfish Fishery Management Plan (PCGFMP) on listed Chinook, coho, chum, sockeye salmon and steelhead and concluded that impacts on listed species were low and not likely to jeopardize the listed species (NMFS 1990; NMFS 1991; NMFS 1992; NMFS 1993; NMFS 1996b; NMFS 1999d; NMFS 2002a). During the 2000 Pacific whiting season, the whiting fisheries exceeded the Chinook bycatch amount specified in the Pacific whiting fishery Biological Opinion's (December 15, 1999) incidental take statement estimate of 11,000 fish by approximately 500 fish. After reviewing the data from the 2000 and 2001 whiting fisheries (including industry bycatch minimization measures), the status of the affected listed Chinook, environmental baseline information, and the incidental take statement from the 1999 whiting biological opinion, NMFS determined that re-initiation of the 1999 whiting biological opinion was not required (NMFS 2002a). The 11,000 fish threshold was not exceeded in 2002 or 2003. NMFS concluded that implementation of the PCGFMP did not pose jeopardy to the listed ESUs, or result in the destruction or adverse modification of critical habitat.

Salmon fisheries off the coast of Southeast Alaska (SEAK) and British Columbia also impact the listed salmon ESUs considered in this opinion. Historical impacts on the listed ESUs and their component stocks in these fisheries are summarized in Tables 8-15 below. Historically SEAK and British Columbian fisheries have accounted for a substantial proportion (up to 82%) of the fishery-related mortality of

[4] Assumes bycatch in other gears is similar to that of whiting which is estimated to be approximately 14,000.

populations in the Puget Sound Chinook Salmon ESU depending on the population. Chinook fisheries off the coasts of SEAK and British Columbia will be managed under the terms of the most recent agreement under the Pacific Salmon Treaty (Treaty). NMFS' assessment of the current Treaty agreement as it applied to the SEAK and British Columbia fisheries concluded that it did not pose jeopardy to the Puget Sound Chinook Salmon ESU (NMFS 1999c). The terms of the agreement will be effective through 2008 (2010 for Fraser Panel fisheries). The Treaty includes a general obligation for each country to reduce exploitation rates in specific fisheries on certain stocks if they are not meeting escapement goals.

Salmon have been harvested in the waters of the Pacific Northwest as long as there have been people here. For thousands of years, native Americans have fished on salmon and other species in these areas for ceremonial and subsistence use and for barter. Salmon were possibly the most important single component of the native American diet, and were eaten fresh, smoked, or dried (Craig and Hacker 1940; Drucker 1965; NMFS 2004a). Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. Development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fishery used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and troll (using hook and line) fisheries were developed. Recreational (sport) fishing began in the late 1800s, occurring primarily in tributary locations.. Eventually the combined ocean and freshwater harvest rates exceeded 80 percent and sometimes 90 percent of the run, contributing to the species' decline (Ricker 1959). As a result of better management tools and information by which to define harvest objectives, and declining abundances, harvest rates on Puget Sound Chinook salmon have declined considerably since the 1980s.

Tables 8-14 show the magnitude and distribution of exploitation rates for individual populations within the ESU over the last twenty years. The tables show the total adult equivalent[5] exploitation rates by brood year as well as how that exploitation was distributed across the major fisheries. The estimates are based on coded wire tag (CWT) recoveries which provide the most direct estimates of exploitation rates. The adult equivalent calculation is a procedure that discounts catch for expected future natural mortality which would occur prior to spawning. The estimates are reported by brood year. For example, the exploitation rate of the 1992 brood year accounts for harvest mortality that occurred on age 2 through 5 year old fish in years 1994-97. The data are complete through the 1997 brood and 2002 fishery. The 1998 brood year is reported, but is incomplete in that the five year old recoveries from the 2003 fishery are not yet available. However, five year old adults are a small proportion of the return each year for Puget Sound stocks (Myers *et al.* 1998). There is generally a year-long time lag in updating the coast-wide CWT data base necessary to provide these estimates. The averages in the following tables correspond to key shifts in fishing regimes: (1) pre- Pacific Salmon Treaty (PST) implementation (1975-1984), (2) post-PST implementation but prior to the implementation of fishery restrictions seen in recent years (1985-1990); (3) recent years when fisheries have been heavily constrained (1991-1998).

Exploitation rates can also be calculated using harvest management models by catch year. These models use the same CWT data to model exploitation rates that occurred in past years. However, once the models are calibrated, they can also be used for management planning purposes to estimate exploitation rates that would be associated with a given fishery structure in a particular year. Because the models are projections,

[5]Adult equivalent exploitation rates are adjusted to account for the potential contribution of fish of a given age to the spawning escapement in the absence of fishing. In other words, it includes those fish that are harvested but that would have survived to spawn in the absence of fishing and does not include fish that are harvested but that would have died of non-fishing related mortality before spawning.

they can be used to characterize exploitation rates that are not available when using the more direct brood year, CWT estimates, or for management units that are not directly represented by CWT data. These exploitation rates are provided for Puget Sound Chinook stocks that are not CWT indicator stocks in Table 15 below. For comparative purposes, exploitation rates for other Puget Sound stocks are also provided. Because these rates are annual rates and not brood year rates, and because they are based on adjustments to a base set of CWT data rather than by individual years, the rates are different than those in Tables 8-14. However, although the absolute rates are different the trends in exploitation rates are generally similar. Table 15 should be used for comparative purposes with rates in the analysis of effects discussion that follows this subsection because the same harvest management model is used to estimate the effects of the 2004 Puget Sound salmon fishery on the ESU.

The Puget Sound Chinook Salmon ESU includes both spring and summer/fall components. Tables 8 through 14 contain brood year exploitation rates for stocks within the ESU for which CWT data are available. Exploitation rates among the Nooksack early, Skagit and White River spring Chinook stocks have been very similar. Most of the harvest occurs in Canadian and Puget Sound fisheries. The historical long-term total exploitation rates (pre-1990 brood) averaged 66 percent or greater (Tables 8-10). Total exploitation rates have declined for the most recent broods (1991-1998), averaging 41, 42, and 52 percent for the Nooksack early, Skagit spring and White River spring populations, respectively (Tables 8-10). This represents a decline of 26 to 44 percent in exploitation rate. The 1991-1998 brood exploitation rates in Puget Sound fisheries for spring Chinook salmon stocks have averaged 12, 21 and 49 percent, respectively. The higher exploitation rate on White River springs in Puget Sound may be the result of a delayed rearing strategy as part of the rebuilding program that generally results in high degree of residualization in Puget Sound waters. Puget Sound spring Chinook stocks are subject to little harvest in PFMC fisheries. The long term average exploitation rate ranges from 1-4 percent. The estimated exploitation rate for the most recent brood years is 1 percent or less (Tables 8-10)(personal communication with D. Simmons, NMFS, April 1, 2004).

The distribution of Puget Sound summer/fall stocks is generally similar to spring stocks although their timing is such that they are subject to somewhat higher exploitation rates. Harvest of Puget Sound summer and fall Chinook again occurs primarily in Canada and Puget Sound. The historical long-term average (pre-1990 brood) total exploitation rate has ranged from 68 to 87 percent for a subset of the summer and fall stocks (Tables 11-14). The most recent brood years have been subject to average total exploitation rates ranging from 39-67 percent (Table 11-14), or a decrease of 22-49 percent in total exploitation rate. The long-term average exploitation rate in Puget Sound fisheries ranged from 28 to 49 percent, and 13 to 55 percent for the most recent brood years. The long-term average exploitation rates in PFMC fisheries ranged from 6-13 percent. For the 1991-1998 brood years, exploitation rates in PFMC fisheries have been 4 percent or less (Tables 11-14)(personal communication with D. Simmons, NMFS, April 1, 2004).

There are two spring Chinook populations in the **Strait of Georgia Region:** the North Fork Nooksack and the South Fork Nooksack. Both are watershed Category 1 populations (Figure 1, Table 3). Nooksack spring Chinook tend to migrate northward. As a result, the majority of harvest mortality occurs in British Columbia, which accounted for approximately 68 percent of fishery mortality from brood years 1991 through 1998 (personal communication with D. Simmons, NMFS, April 1, 2004). On average, Alaskan fisheries accounted for 0 percent, Puget Sound commercial net and recreational fisheries for 30 percent, and PFMC fisheries for 2 percent (personal communication with D. Simmons, NMFS, April 1, 2004). The total exploitation rate on both populations has declined by 45 percent since the 1980's, averaging 74 percent from 1981 through 1984, and 41 percent from 1991 through 1998 brood years (Table 8)(personal

communication with D. Simmons, NMFS, April 1, 2004).

The **Whidbey/Main Basin Region** includes the Skagit, Stillaguamish and Snohomish river systems (Figure 1, Table 3). The three basins contain 10 Category 1 Chinook populations (PSTRT 2004a). As with the Nooksack spring populations, a large proportion of the harvest related mortality occurs to the north, outside of the jurisdiction of the state and Tribes. Canadian fisheries accounted for 46 and 52 percent of salmon fishing-related mortality, on average, for Skagit spring Chinook and Skagit summer and fall Chinook, respectively, from 1993 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004; FRAM 2003). Exploitation rates for summer and fall chinook salmon populations fell 43 percent from levels in excess of 60 percent during 1985-88, to an average in recent years of 34 percent (FRAM 2003). Over the same period, exploitation rates for spring Chinook salmon fell 49 percent, from an average of 81 percent during 1981-84 brood years (primarily 1985-88 return years) to a recent average of 42 percent (Table 9)(personal communication with D. Simmons, NMFS, April 1, 2004).

A slightly higher proportion of the total harvest of the Stillaguamish Management Unit occurs in Canada than in Puget Sound. In recent years, approximately 16 percent of Stillaguamish fishing-related mortality occurred in Alaska, 51 percent in Canada, 33 percent in Puget Sound commercial and recreational fisheries, and less than 1 percent in PFMC fisheries (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 11). Exploitation rates have fallen 43 percent since the mid-1980's from rates averaging 68 percent to approximately 39 percent in recent years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 11).

Approximately 25 percent of fishing-related mortality on the Skykomish and Snoqualmie populations occurred in Alaska and Canada, 6 percent in PFMC, and 69 percent in Puget Sound net and recreational fisheries (CTC 2003). Exploitation rates have declined by 62 percent from an average of 62 percent in the early 1980's to an average of 23 percent in recent years (FRAM 2003).

The **Southern Basin region** contains four major Chinook-bearing watersheds: Lake Washington, and the Duwamish-Green, Puyallup and Nisqually Rivers (Figure 1, Table 3). The PSTRT identified six populations in the region (PSTRT 2004a). Three of the populations are designated watershed Category 1 and three Category 2. These systems were managed for hatchery harvest rates for decades. Data collection has begun to try to assess system productivities and to quantify the contribution of hatchery strays to escapements, but it will be several years before sufficient data are available for analysis. Beginning in 2000, management transitioned in the Nisqually and Puyallup systems from a focus on hatchery management to management objectives based on naturally spawning adults. In South Puget Sound, past strategies to maximize harvest of hatchery stocks resulted in exploitation rates of 80 percent or more (Tables 12,13,15).

Unlike the populations in the Strait of Georgia and Whidbey/Main Basin regions, the majority of fishing-related mortality on Southern Basin populations has historically occurred in Puget Sound fisheries. For the 1991 through 1998 brood years, Canadian fisheries accounted for approximately 4-39 percent of fishing-related mortality, Puget Sound commercial and recreational fisheries 50-95 percent, PFMC fisheries 1-9 percent, and Alaska fisheries 2 percent or less (CTC 2003). Total exploitation rates have declined by 14 to 63 percent, depending on the population, since the early 1980s averaging 68-90 percent in the 1980s for most populations, to 29 to 77 percent in recent years (Tables 7 and 10)(FRAM 2003).

The **Hood Canal Region** has two fall Chinook populations, one in the Skokomish River, and a second that

is comprised of three Hood Canal tributaries (Dosewallips, Duckabush and Hamma Hamma Rivers)(PSTRT 2004a). Both the Skokomish and Mid-Hood Canal Rivers populations are considered watershed Category 2 populations and thus are a composite of natural- and hatchery-origin fish that are genetically indistinguishable (Figure 1, Table 3).

Coded-wire tag recoveries indicate Canadian fisheries accounted for 39 percent of harvest mortality, Alaskan fisheries 2 percent, Puget Sound commercial and sport fisheries 50 percent, and PFMC fisheries 9 percent from 1991 through 1998 brood years[6] (Table 14). The overall exploitation rate for Hood Canal summer-fall Chinook salmon declined by 49 percent since the early 1990s, averaging 87 percent from 1985 through 1990 brood years, and 44 percent from 1991 through 1998 brood years (Table 14)(personal communication with D. Simmons, NMFS, April 1, 2004).

The **Strait of Juan de Fuca Region** has two watershed Category 1 populations including a native, spring-timed population on the Dungeness, and a native, fall-timed population on the Elwha (Figure 1, Table 3)(PSTRT 2004a). The Dungeness population is considered critical in status due to chronically low spawning escapement levels (PSIT/WDFW 2004; and WDF *et al.* 1993) and rely on artificial propagation programs to sustain them.

Coded-wire tag data for these two populations from 1991 through 1996, indicate British Columbia fisheries accounted for 54 percent of the total harvest mortality, Alaskan fisheries 10 percent, Washington recreational fisheries 21 percent, Washington troll fisheries 5 percent, and Puget Sound net fisheries 9 percent (PSC data cited in NMFS 2000b). Exploitation rates on these populations have declined by 59 percent on average, from 76 percent in the 1980s to 31 percent in recent years (FRAM 2003).

NMFS is currently evaluating implementation of a resource management plan for Puget Sound Chinook (RMP), jointly developed by the Washington Department of Fish and Wildlife, and the Puget Sound treaty tribes, under Limit 6 of the Endangered Species Act (ESA) 4(d) Rule. The proposed RMP would regulate commercial, recreational, ceremonial, and subsistence salmon fisheries potentially affecting the listed Puget Sound Chinook salmon ESU within the marine and freshwater areas of Puget Sound through April 30, 2010. Harvest objectives specified in the RMP account for fisheries-related mortality of Puget Sound Chinook salmon throughout the migratory range of this species – from Oregon and Washington to Southeast Alaska. The RMP also includes implementation, monitoring, and evaluation procedures designed to ensure fisheries are consistent with the RMP's objectives for conservation and use. Fisheries within the action area will be managed to meet the "Rebuilding Exploitation Rates" (RERs), escapement goals and other harvest objectives detailed in the RMP, after taking into account the mortality that has already occurred in SEAK and British Columbian fisheries (PSIT/WDFW 2004).

Recreational fisheries targeting on non-salmonid species have the potential to take Chinook salmon. (Commercial fisheries on non-salmonid species have been discussed in the Environmental Baseline section of this opinion). Within the action area these are primarily fisheries for groundfish species. In general these species occupy different habitats and strata in the water column. The greatest potential for interaction occurs in a limited number of areas where Chinook and the target species exist at similar depths. Chinook

[6] Managers assume marine harvest distribution of Mid-Hood Canal Chinook similar to that of Chinook from George Adams Hatchery; however, the terminal-area exploitation rate is lower because Chinook fisheries are confined to southern Hood Canal and the Skokomish River.

may also encounter groundfish gear as it is deployed. At this time the extent of these impacts is unquantified. However, an assessment of these impacts will be included in a Fishery Management and Evaluation Plan currently under development by WDFW.

There are no other tribal, local, private, or federal harvest actions unrelated to the actions considered in this opinion that substantially affect the environment of listed Chinook in the action area.

Table 8 **Summary of total adult equivalent exploitation rates for the Nooksack early stock (yearling component) from the Puget Sound Chinook ESU (**D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004**).**

	Nooksack Early (Yearling)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981	0.80	0.03	0.57	0.00	0.20	0.00
1982	0.75	0.00	0.75	0.00	0.00	0.00
1983						
1984	0.66	0.00	0.52	0.01	0.14	0.00
1985						
1986	0.86	0.00	0.18	0.00	0.68	0.00
1987	0.54	0.00	0.30	0.02	0.22	0.00
1988	0.58	0.00	0.47	0.01	0.10	0.00
1989	0.56	0.03	0.41	0.02	0.11	0.00
1990	0.55	0.01	0.39	0.00	0.15	0.00
1991						
1992	0.37	0.00	0.26	0.00	0.11	0.00
1993	0.42	0.00	0.23	0.01	0.18	0.00
1994	0.39	0.00	0.24	0.00	0.16	0.00
1995	0.39	0.00	0.32	0.03	0.04	0.00
1996	0.48	0.00	0.35	0.01	0.12	0.00
1997						
1998						
1977-1984	0.74	0.01	0.61	0.00	0.11	0.00
1985-1990	0.62	0.01	0.35	0.01	0.25	0.00
1991-1996	0.41	0.00	0.28	0.01	0.12	0.00
Distribution of Fishing-Related Mortality						
1977-1984		1.3%	83.1%	0.3%	15.2%	0.0%
1985-1990		1.2%	56.8%	1.5%	40.6%	0.0%
1991-1996		0.0%	68.2%	2.3%	29.5%	0.0%

Table 9. Summary of total adult equivalent exploitation rates for the Skagit Spring stock (yearling component) from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Skagit Springs (Yearling)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981	0.72	0.02	0.50	0.00	0.20	0.00
1982	0.83	0.00	0.66	0.01	0.17	0.00
1983	0.91	0.00	0.46	0.00	0.46	0.00
1984	0.78	0.01	0.34	0.00	0.37	0.00
1985	0.71	0.00	0.33	0.03	0.24	0.00
1986	0.73	0.01	0.37	0.04	0.30	0.00
1987	0.72	0.00	0.29	0.06	0.36	0.00
1988						
1989						
1990	0.57	0.00	0.37	0.02	0.16	0.00
1991						
1992						
1993	0.51	0.00	0.23	0.00	0.27	0.00
1994	0.41	0.02	0.22	0.00	0.17	0.00
1995	0.40	0.00	0.20	0.00	0.19	0.00
1996	0.25	0.00	0.12	0.00	0.13	0.00
1997	0.52	0.01	0.23	0.02	0.25	0.00
1998	0.41	0.00	0.17	0.00	0.23	0.00
1977-1984	0.81	0.01	0.49	0.00	0.30	0.00
1985-1990	0.68	0.00	0.34	0.04	0.27	0.00
1991-1998	0.42	0.00	0.19	0.00	0.21	0.00
Distribution of Fishing-Related Mortality						
1977-1984		0.9%	60.3%	0.2%	38.6%	0.0%
1985-1990		0.3%	49.9%	5.2%	44.6%	0.0%
1991-1998		1.1%%	46.0%	0.8%	52.1%	0.0%

Table 10. Summary of total adult equivalent exploitation rates for the White Spring stock from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	White River Spring					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1977						
1978						
1979	0.90	0.00	0.01	0.05	0.84	0.00
1980	0.78	0.00	0.16	0.00	0.62	0.00
1981	0.51	0.00	0.00	0.00	0.51	0.00
1982	0.73	0.00	0.05	0.00	0.68	0.00
1983	0.78	0.00	0.04	0.02	0.72	0.00
1984	0.71	0.00	0.13	0.03	0.55	0.00
1985	0.70	0.00	0.03	0.03	0.64	0.00
1986	0.75	0.00	0.03	0.03	0.68	0.00
1987	0.68	0.00	0.03	0.03	0.61	0.00
1988	0.63	0.00	0.10	0.06	0.48	0.00
1989	0.63	0.00	0.03	0.02	0.58	0.00
1990	0.74	0.00	0.04	0.00	0.70	0.00
1991	0.55	0.00	0.01	0.00	0.54	0.00
1992	0.50	0.00	0.01	0.00	0.49	0.00
1993	0.46	0.00	0.01	0.00	0.45	0.00
1994	0.45	0.00	0.01	0.01	0.43	0.00
1995	0.39	0.00	0.01	0.00	0.38	0.00
1996	0.54	0.00	0.10	0.00	0.44	0.00
1997	0.74	0.00	0.00	0.01	0.72	0.00
1998						
1977-1984	0.68	0.00	0.05	0.01	0.62	0.00
1985-1990	0.69	0.00	0.04	0.03	0.62	0.00
1991-1997	0.52	0.00	0.01	0.00	0.49	0.00
Distribution of Fishing-Related Mortality						
1977-1984		0.0%	7.9%	1.8%	90.2%	0.0%
1985-1990		0.0%	6.4%	4.3%	89.3%	0.0%
1991-1997		0.0%	3.9%	0.8%	95.3%	0.0%

Table 11. Summary of total adult equivalent exploitation rates for the Stillaguamish summer stock from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Stillaguamish Fall					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986	0.66	0.00	0.32	0.05	0.28	0.00
1987	0.50	0.01	0.30	0.04	0.16	0.00
1988	0.70	0.00	0.26	0.12	0.32	0.00
1989	0.89	0.00	0.46	0.10	0.33	0.00
1990	0.66	0.01	0.28	0.03	0.34	0.00
1991	0.55	0.06	0.30	0.01	0.18	0.00
1992	0.40	0.01	0.25	0.01	0.13	0.00
1993	0.49	0.05	0.22	0.00	0.22	0.00
1994	0.44	0.11	0.18	0.00	0.16	0.00
1995	0.35	0.09	0.14	0.00	0.11	0.00
1996	0.30	0.07	0.17	0.00	0.06	0.00
1997	0.30	0.08	0.14	0.00	0.08	0.00
1998	0.28	0.01	0.18	0.00	0.09	0.00
1977-1984						
1985-1990	0.68	0.00	0.32	0.07	0.28	0.00
1991-1998	0.39	0.06	0.20	0.00	0.13	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		0.4%	47.8%	10.1%	41.8%	0.0%
1991-1998		15.6%	50.9%	0.8%	32.7%	0.0%

Table 12. Summary of total adult equivalent exploitation rates for the Green River fall stock from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Green River fall (Green/Grovers Creek)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986	0.81	0.00	0.27	0.10	0.44	0.00
1987	0.79	0.05	0.28	0.08	0.37	0.00
1988	0.84	0.00	0.29	0.11	0.44	0.00
1989	0.76	0.00	0.27	0.09	0.40	0.00
1990	0.75	0.00	0.30	0.02	0.42	0.00
1991	0.58	0.00	0.12	0.01	0.46	0.00
1992	0.58	0.01	0.12	0.04	0.41	0.00
1993	0.53	0.01	0.14	0.02	0.36	0.00
1994	0.47	0.01	0.15	0.02	0.29	0.00
1995	0.44	0.03	0.05	0.05	0.31	0.00
1996	0.60	0.01	0.19	0.03	0.37	0.00
1997	0.70	0.00	0.21	0.05	0.44	0.00
1998	0.73	0.01	0.20	0.04	0.48	0.00
1977-1984						
1985-1990	0.78	0.01	0.28	0.08	0.41	0.00
1991-1998	0.58	0.01	0.15	0.03	0.39	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		1.4%	35.6%	10.3%	52.7%	0.0%
1991-1998		1.7%	25.5%	5.4%	67.4%	0.0%

Table 13. Summary of total adult equivalent exploitation rates for the Nisqually fall (Kalama) stock from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Nisqually fall					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979	0.98	0.00	0.39	0.06	0.53	0.00
1980	0.99	0.00	0.39	0.00	0.60	0.00
1981	0.97	0.00	0.25	0.01	0.71	0.00
1982	0.86	0.00	0.29	0.03	0.54	0.00
1983	0.92	0.00	0.32	0.01	0.59	0.00
1984	0.96	0.00	0.41	0.07	0.38	0.10
1985	0.83	0.00	0.23	0.08	0.51	0.00
1986	0.91	0.00	0.27	0.13	0.51	0.00
1987	0.87	0.00	0.08	0.20	0.57	0.01
1988	0.83	0.00	0.28	0.16	0.39	0.00
1989	0.84	0.00	0.25	0.11	0.48	0.00
1990	0.73	0.00	0.20	0.03	0.50	0.00
1991	0.57	0.00	0.10	0.02	0.44	0.00
1992	0.73	0.00	0.10	0.02	0.61	0.00
1993	0.66	0.00	0.11	0.01	0.54	0.00
1994	0.75	0.00	0.08	0.03	0.65	0.00
1995	0.57	0.00	0.07	0.00	0.50	0.00
1996	0.72	0.00	0.09	0.02	0.61	0.00
1997	0.65	0.00	0.12	0.02	0.51	0.00
1998	0.72	0.00	0.10	0.06	0.56	0.00
1977-1984	0.93	0.00	0.32	0.03	0.56	0.02
1985-1990	0.83	0.00	0.22	0.12	0.49	0.00
1991-1998	0.67	0.00	0.10	0.02	0.55	0.00
Distribution of Fishing-Related Mortality						
1977-1984		0.0%	34.0%	3.5%	59.9%	2.6%
1985-1990		0.0%	26.2%	14.2%	59.2%	0.5%
1991-1998		0.2%	14.2%	3.5%	82.1%	0.0%

Table 14. Summary of total adult equivalent exploitation rates for the Skokomish (George Adams) fall stock from the Puget Sound Chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Skokomish fall (George Adams)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985	0.91	0.00	0.20	0.12	0.58	0.00
1986	0.93	0.00	0.27	0.16	0.51	0.00
1987	0.87	0.01	0.29	0.12	0.45	0.00
1988	0.69	0.00	0.19	0.12	0.38	0.00
1989	0.87	0.00	0.45	0.15	0.27	0.00
1990	0.69	0.00	0.19	0.12	0.38	0.00
1991	0.51	0.00	0.23	0.01	0.27	0.00
1992	0.46	0.00	0.17	0.06	0.23	0.00
1993	0.45	0.02	0.09	0.01	0.16	0.00
1994	0.25	0.00	0.04	0.00	0.20	0.00
1995	0.29	0.02	0.09	0.01	0.16	0.00
1996	0.46	0.00	0.22	0.05	0.19	0.00
1997	0.59	0.01	0.25	0.07	0.25	0.00
1998	0.53	0.01	0.20	0.06	0.25	0.00
1977-1984						
1985-1990	0.87	0.00	0.27	0.13	0.46	0.00
1991-1998	0.44	0.01	0.17	0.04	0.22	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		0.4%	30.9%	15.4%	53.2%	0.0%
1991-1998		1.9%	39.1%	8.6%	50.4%	0.0%

Table 15. Summary of total adult equivalent exploitation rates for Puget Sound Chinook populations based on the Fishery Regulation and Assessment harvest management model (FRAM)(FRAM 2003).

Return Year	Skagit summer/fall	Snohomish	Dungeness/ Elwha	Lake Washington	Puyallup	Nooksack early	Skagit spring	White	Stillaguamish	Skokomish	Duwamish-Green	Nisqually
1983	0.78	0.73	0.77	0.82	0.82	0.48	0.74	0.55	0.69	0.79	0.86	
1984	0.72	0.63	0.62	0.75	0.75	0.43	0.62	0.35	0.58	0.67	0.57	0.91
1985	0.65	0.54	0.78	0.77	0.77	0.42	0.54	0.95	0.40	0.69	0.73	0.84
1986	0.59	0.60	0.88	0.68	0.68	0.41	0.54	0.41	0.58	0.80	0.57	0.89
1987	0.60	0.47	0.78	0.78	0.78	0.40	0.59	0.32	0.44	0.81	0.51	
1988	0.58	0.65	0.67	0.86	0.86	0.49	0.57	0.33	0.54	0.74	0.62	0.83
1989	0.71	0.51	0.68	0.75	0.75	0.36	0.73	0.33	0.44	0.76	0.59	0.90
1990	0.50	0.49	0.76	0.69	0.69	0.30	0.48	0.31	0.44	0.70	0.71	0.85
1991	0.54	0.51	0.75	0.81	0.81	0.34	0.63	0.44	0.36	0.68	0.64	0.78
1992	0.63	0.60	0.58	0.80	0.80	0.34	0.56	0.30	0.41	0.77	0.74	0.85
1993	0.65	0.60	0.54	0.61	0.61	0.30	0.46	0.22	0.27	0.61	0.74	0.82
1994	0.57	0.47	0.64	0.37	0.37	0.27	0.50	0.43	0.27	0.65	0.68	0.96
1995	0.60	0.62	0.48	0.31	0.31	0.23	0.46	0.31	0.40	0.35	0.37	0.89
1996	0.32	0.42	0.42	0.27	0.27	0.18	0.44	0.31	0.34	0.30	0.41	0.87
1997	0.38	0.29	0.34	0.29	0.29	0.21	0.41	0.20	0.29	0.37	0.31	0.76
1998	0.24	0.23	0.2	0.15	0.15	0.15	0.28	0.19	0.14	0.17	0.30	0.79
1999	0.33	0.3	0.45	0.19	0.19	0.16	0.21	0.25	0.19	0.45	0.28	0.80
2000	0.24	0.25	0.49	0.42	0.42	0.16	0.30	0.17	0.25	0.47	0.50	0.67
2001	0.40	0.23	0.18	0.27	0.27	0.18	0.21	0.17	0.17	0.26	0.49	0.57
2002	0.26	0.19	0.19	0.27	0.27	0.14	0.23	0.17	0.14	0.25	0.55	0.71
2003	0.48	0.19	0.22	0.31	0.31	0.20	0.23	0.18	0.17	0.26	0.50	0.76

3.3.5 Natural Factors Causing Variability in Population Abundance

Changes in the abundance of salmonid populations are substantially affected by changes in freshwater, estuarine and marine environments. For example, large scale climatic regimes, such as El Niño, cause changes in ocean productivity. Much of the Pacific coast was subject to a series of very dry years during the first part of the 1990s. In more recent years, severe flooding has adversely affected some stocks. For example, flood events in 1990 and 1995 may have contributed to the low productivity of the 1990 and 1995 brood years for the Nooksack early and some of the Skagit spring and summer/fall Chinook salmon populations.

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that rebounding seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, have resulted in substantial mortality for salmonids.

Recent evidence suggests that marine survival of salmon species fluctuates in response to 20-30 year long periods of either above or below average survival that is driven by long-term cycles of climatic conditions and ocean productivity (Beamish and Bouillon 1993; Beamish *et al.* 1999; Cramer *et al.* 1999; Hare *et al.* 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation (PDO) (Mantua *et al.* 1997). Poor ocean conditions that affect the productivity of Northwest salmonid populations appear to have been an important contributor to the decline of many populations prior to listing. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a sub-adult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. For example, the time series of survival rate information for several Puget Sound spring and fall Chinook salmon populations shows highly variable or declining trends in early ocean survival, with very low survival rates in recent brood years (Figure 5)(personal communication with D. Simmons, NMFS, 2003). Ocean conditions may be improving which may have contributed to the increase in abundance observed in recent years for some populations, especially in the Columbia River. However, NMFS does not have data to corroborate an improved marine survival trend for Puget Sound Chinook populations at this time. The survival and recovery of these species will depend on their ability to persist through periods of low ocean survival when stocks may depend on better quality freshwater habitat and lower relative harvest rates.

In this opinion, NMFS focuses on harvest, in the context of the environmental baseline and the current status of the species. Although harvest can be reduced in response to the species' depressed status and the reduced productivity that results from the degradations related to other human activities, the recovery of the listed species depends on improving the productivity of the natural populations in the wild. These improvements can only be made by addressing the factors of decline related to all of the "H's" that will be the subject of future opinions and recovery planning efforts.

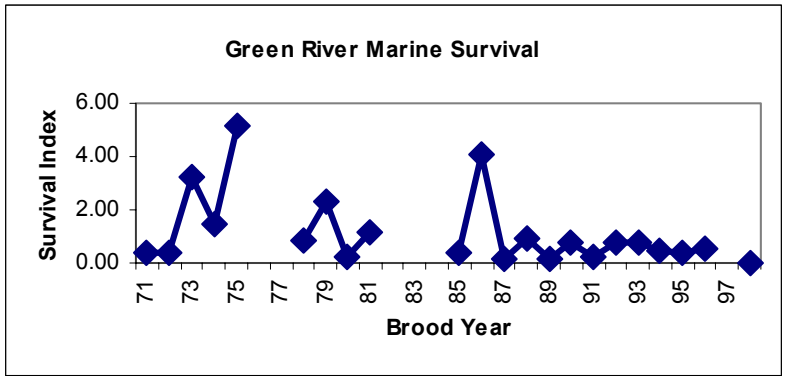


Figure 4. Early ocean survival rate index for Green River fall Chinook salmon

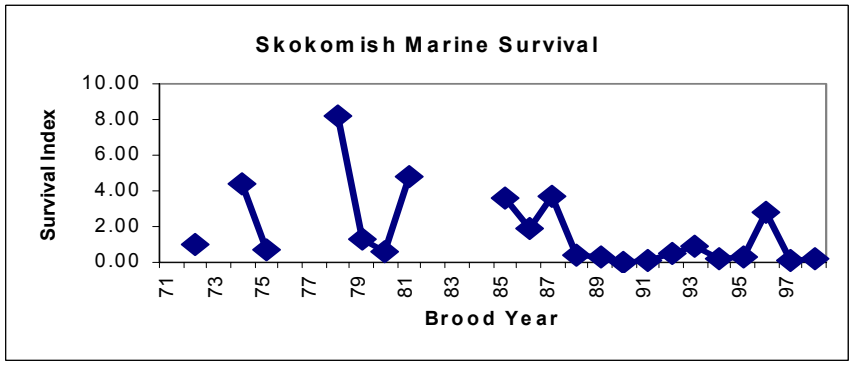


Figure 5. Early ocean survival rate index for Skokomish River fall Chinook salmon

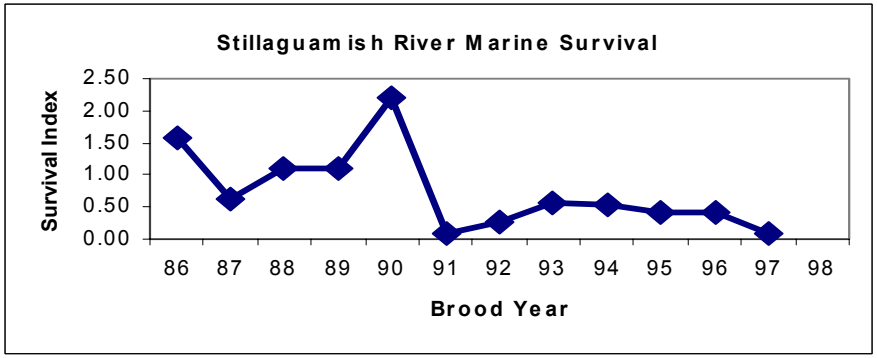


Figure 6. Early ocean survival rate index for Stillaguamish summer Chinook salmon

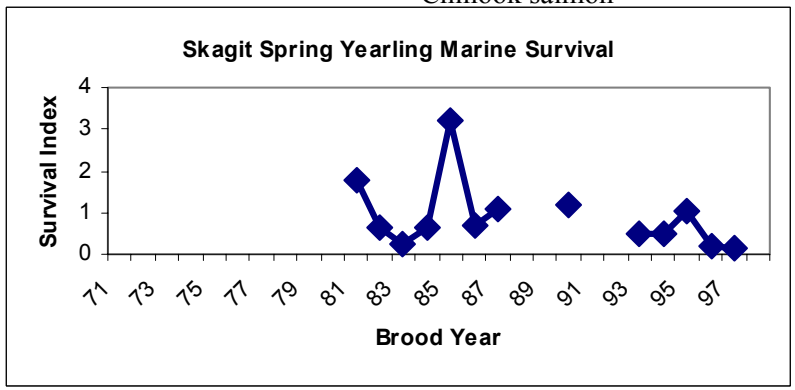


Figure 7. Early ocean survival index for Skagit spring Chinook salmon (yearling component)

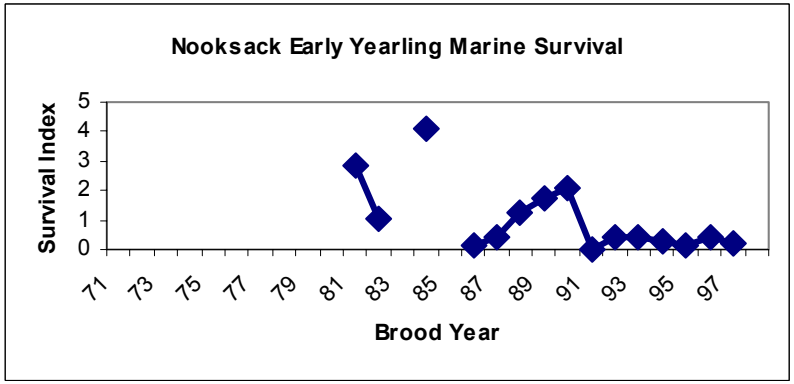


Figure 8. Early ocean survival index for Nooksack early Chinook salmon (yearling component)

Federal, tribal, state and local governments and community organizations are currently collaborating in the development of a recovery plan for listed salmon species in Puget Sound, including the Puget Sound Chinook Salmon ESU. This effort is collectively called the Shared Strategy forum. The Shared Strategy plan will include conservation goals for listed Puget Sound salmon; and the habitat, hatchery, and harvest actions that will need to be taken to achieve these goals for each watershed in Puget Sound and the Strait of Juan de Fuca. When complete, the Shared Strategy will provide its plan to NMFS for assessment as to whether the plan would suffice as the recovery plan for Puget Sound salmon listed under the ESA.

3.4 Analysis of Effects

3.4.1 Effects of the Proposed Actions on Species and on Critical Habitat

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined at 50 CFR §402.02. This section of the biological opinion applies those standards in determining whether the proposed fishery is likely to jeopardize the continued existence of one or more of the threatened or endangered salmon species (ESUs) that may be adversely affected by the fishery, or adversely impact critical habitat. This analysis considers the direct, indirect, interrelated and interdependent effects of the proposed fishery and compares it against the environmental baseline to determine if the proposed fishery will appreciably reduce the likelihood of survival and recovery of the listed Puget Sound Chinook Salmon ESU. Fishing activities may also result in non-lethal take associated with the operation of certain gear types or fishing methods, e.g., effects on fish behaviour. However, these latter effects are unknown and unquantifiable at this time.

3.4.1.1 Assessment Approach

Analysis of effects were based on quantitative assessments where possible and more qualitative considerations where necessary. Different methods and different types of information were used for the various populations within the ESU, reflecting what was available or could be developed as part of this consultation. NMFS expects that more quantitative and holistic analyses and risk assessments will become available in time, and that standards may change as new information becomes available.

The method used to quantitatively assess the effects of fishing activities was developed with three objectives. First, NMFS sought to evaluate the proposed fisheries using biologically-based measures of the total exploitation rate that occurred across the entire migratory range of the species. Second, NMFS sought to use an approach that was consistent with the concepts developed by the Northwest Fisheries Science Center for the purpose of defining the conservation status of populations and ESUs, i.e.,Viable Salmonid Populations (VSP) (McElhany *et al.* 2000). Finally, NMFS sought to develop an approach for defining target exploitation rates that could be related directly to the regulatory definition of jeopardy. The product of this approach is a Rebuilding Exploitation Rate (RER) for representative populations within an ESU (NMFS 2000c). NMFS can then evaluate the proposed fisheries, in part, by comparing the RERs to population-specific exploitation rates that can be anticipated as a result of the expected fishing-related mortality from the implementation of the Puget Sound salmon fishery, recognizing that the jeopardy determination must be made with respect to the overall ESU. To date, RERs have been developed for a limited set of populations in the Puget Sound Chinook Salmon ESU and for the Coweeman population in the Lower Columbia River Chinook Salmon ESU. NMFS has used RERs as part of its assessment of proposed harvest actions in several biological opinions and application of take limits under the ESA 4(d) Rule since 1999 (NMFS 1999c, NMFS 2000b, NMFS 2001a, NMFS 2003a; NMFS

2004c).

Where available, exploitation rates and escapements are compared to population-specific conservation standards established by NMFS to ascertain whether fisheries will appreciably reduce survival and recovery of the ESU. Conservation standards are represented by RERs, critical escapement thresholds (CET) and viable escapement thresholds (VETs).

Rebuilding Exploitation Rates (RER): the highest rate of harvest that will achieve the following ESA conservation criteria. Over the long term (25 years), harvest at the RER level will achieve: 1a) a high (80%) probability of rebuilding or 1b) no more than a 10 percentage point reduction in the probability of rebuilding, and 2) a very low (5%) probability of the population falling to the critical threshold compared with a zero harvest baseline. Fishing regimes that exert exploitation rates below the RER level, by definition, do not pose jeopardy to the ESU. Fishing regimes that result in exploitation rates above the RERs may also not pose jeopardy to the ESU depending on the status and distribution of the Chinook salmon populations throughout the ESU.

Critical escapement threshold (CET): a point of biological instability, below which (1) depensatory processes are likely to reduce the populations below replacement; (2) the population is at risk from inbreeding depression or fixation of deleterious mutations; or (3) productivity variation due to demographic stochasticity becomes a substantial source of risk (McElhany *et al.* 2000). This point is not precisely known for any population, but may be estimated by risk assessment if the current productivity of a population can be estimated. Based on theoretical assessment of ecological and genetic risk (McElhany *et al.* 2000; NMFS 2000c; NMFS 2001a) a generic critical threshold of 200 spawning adults has been used for populations for which population-specific data is unavailable or insufficient to estimate productivity.

Viable escapement threshold (VET): (in the context of this analysis) is a level of spawning escapement associated with rebuilding populations to recovery, consistent with current environmental conditions. For most populations these thresholds are well below the escapement levels associated with full recovery, but achieving these goals under current conditions is a necessary step to eventual recovery when habitat and other conditions are more favorable. Where data are available, viable escapement thresholds have been defined consistent with the current productivity and capacity of spawning habitat. Where such information is not available, the generic viable escapement threshold (1,250 spawning adults) defined by NMFS for Viable Salmonid Populations (McElhany *et al.* 2000; NMFS 2000c; NMFS 2001a) is used as a reference point. By definition these generic thresholds offer only general guidance as to what generally represents points of stability or instability. Some populations may be fairly robust at very low abundances, while Chinook salmon populations in large river systems may become unstable at higher abundances depending on resource location and spawner density. However, without population-specific information, these generic guidelines offer the best available information.

The RERs, and the viable and critical escapement thresholds against which they were derived, are summarized in Table 16.

Table 16. RERs, assuming low survival rates, and the critical and viable escapement thresholds used in the Risk Assessment Procedure. RERs are expressed as both CWT rates and equivalent rates compatible with the Fisheries Regulation Assessment Model (FRAM) used for domestic harvest management planning. Escapement thresholds are in terms of natural-origin adults.

Management Unit	Population	Recovery Exploitation Rates		Escapement Threshold	
		CWT	FRAM	Critical	Viable
Nooksack early	NF Nooksack SF Nooksack	0.21	0.12	400 200 200	500
Skagit spring	Suiattle	0.50	0.41	170	400
	Upper Sauk	0.46	0.38	130	330
Skagit summer/ fall	Upper Skagit	0.54	0.60	967	7,454
	Lower Skagit	0.33	0.49	251	2,182
	Lower Sauk	0.36	0.51	200	681
Stillaguamish summer/fall	NF Stillaguamish	0.45	0.32	300	552
	SF Stillaguamish	0.28	0.24	200	300
Snohomish summer/fall	Skykomish	0.24	0.18	1,650	3,500
Duwamish-Green fall	Duwamish-Green River	0.62	0.53	835	5,523

Because RER objectives are expressed in terms of a total exploitation rate and some of the associated impacts occur in Canadian and Alaskan fisheries, it is necessary to make assumptions about anticipated impacts in the northern fisheries. In general, Alaskan fisheries will be managed up to the limits allowed under the PST agreement, and Canadian fisheries will be managed up to the PST limit for most fisheries (FRAM 2004). Assumptions about fishing levels in these northern fisheries were also incorporated into the modeling analysis of impacts in previous opinions and 4(d) determinations (NMFS 1999c, NMFS 2001c, NMFS 2003a) and a Draft Environmental Impact Statement which evaluates the implementation of a proposed fishing plan for Puget Sound Chinook salmon under the ESA 4(d) Rule and is currently under public review (NMFS 2004a).

Estimated impacts from the fisheries authorized by the proposed Federal actions vary by population, consistent with population-specific management objectives. Through the pre-season harvest management planning process, the impacts to Puget Sound Chinook populations from various fishery harvest regimes are evaluated by a fishery model (Fishery Regulation Assessment Modeling or FRAM). Puget Sound salmon fisheries and those under the jurisdiction of the Pacific Fisheries Management Council (PFMC) are considered in concert during this pre-season planning process to develop the various harvest regime model inputs (taking into account anticipated Alaskan and Canadian harvest of Puget Sound Chinook

populations).

For the 2004 fishing season, FRAM model run 1604 (dated April 14, 2004) is the final product of this pre-season harvest management planning process. Anticipated exploitation rates for the Canadian and Alaskan fisheries, the PFMC, total ocean, Puget Sound, and the total southern U.S. (SUS) fisheries by Puget Sound Chinook management unit are depicted in Table 17. Regulations for the Puget Sound salmon fisheries may be modified in-season by the co-managers based on abundance, timing, and fishery monitoring information. Any modification to the regulations in-season must be consistent with the management objectives described during preseason planning. Although NMFS has not yet made its determination under the 4(d) Rule, the co-managers have stated their intent to manage the 2004 fisheries under the terms of the 2004-2009 Puget Sound Chinook harvest resource management plan.

Table 17. Total projected 2004 FRAM adult equivalent exploitation rates on Puget Sound Chinook salmon populations in various fisheries compared with their RERs (%) (FRAM 2004).

Management Unit		SE Alaska	Canada	PFMC	Total ocean	Puget Sound	Total South U.S.	Total (all fisheries)	RER	2004 diff. from RER
RER Stocks	Nooksack Early	2	19	1	22	5	6	27	12	+15
	Skagit Spring	<1	16	1	18	16	17	33	38	-5
	Skagit Summer/Fall	4	28	<1	33	6	7	38	49	-11
	Stillaguamish	<1	13	1	15	8	9	23	24	-1
	Snohomish	1	15	1	17	12	13	29	18	+11
	Duwamish-Green	1	24	3	28	34	37	62	53	+9
Non RER Stocks	Dungeness/Elwha	3	17	1	21	4	5	24		
	Lake Washington	1	24	3	28	15	18	43		
	White River	0	1	1	2	17	18	19		
	Puyallup	1	24	3	28	23	26	50		
	Nisqually	1	13	3	17	59	62	76		
	Mid-Hood Canal	0	19	3	22	8	11	31		
	Skokomish	0	19	3	22	30	33	52		

3.4.1.2 Effects on Puget Sound Chinook

As presented in sections 3.2 (Status) and 3.3 (Environmental Baseline), the Puget Sound Chinook Salmon ESU is composed of spring, summer and fall-timed populations. All Puget Sound Chinook salmon populations are impacted by ocean fisheries off Alaska, Canada, and the southern U.S. Most are subject to substantial recreational and commercial fisheries inside Puget Sound. In recent years, as catches have been reduced to protect weak stocks, estimated exploitation rates in Puget Sound salmon fisheries have averaged 12 to 49 percent for Puget Sound spring stocks (Tables 8-10), a reduction of 23 to 48 percent from the exploitation rates experienced in the 1980's, depending on the population. The 2004 model estimates are for exploitation rates in Puget Sound fisheries of 4 to 17 percent and in southern U.S. fisheries from 5 to 18 percent, depending on the management unit (FRAM 2004). Total exploitation rates on Puget Sound spring Chinook populations in 2004 are expected to range from 19 to 33 percent (FRAM 2004)(Table 17).

For spring-type populations, to date, RERs have been developed for the Skagit spring Chinook populations and the Nooksack early Chinook salmon management unit. The total projected exploitation rate of 38 percent in 2004 is below the RERs for the Upper Sauk and Suiattle (Skagit) spring Chinook salmon populations of 38 and 41 percent, respectively (Table 17). The exploitation rate of 5 percent for the Puget Sound fisheries is well below the RER for the Nooksack early management unit, but the total exploitation rate is expected to exceed the RER of 12 percent (Table 17). The RER for the Nooksack early management unit is not expected to be met in 2004 even with total closure of all southern U.S. fisheries.

In general, 2004 escapements for Puget Sound spring Chinook salmon populations are expected to remain stable or continue to increase when compared with recent year average escapement (Table 18). The Nooksack, Skagit and White River spring Chinook populations are expected to exceed their viable escapement thresholds in 2004. Escapement for the Dungeness population in 2004 is expected to exceed its post-listing average but remain well below its viable threshold. The White River, Dungeness and Nooksack populations depend heavily on their associated hatchery conservation programs which are listed as essential to recovery of the ESU.

Nooksack early Chinook - The 1999 to 2002 average escapement of 180 natural-origin spawners for the North Fork Nooksack River population is below the NMFS-derived critical threshold of 200 fish. The North Fork Nooksack River natural-origin population has an increasing escapement trend since listing (Table 4). The South Fork Nooksack River natural-origin population has also exhibited an increasing escapement trend since listing (Table 4). The 1999 to 2002 average escapement of 249 natural-origin spawners for the South Fork Nooksack River population is slightly above the NMFS-derived critical threshold of 200 fish (Table 4). Escapement in 2004 for the Nooksack early Chinook Management Unit is anticipated to be 570 natural-origin adult spawners. Using the recent year average escapement distribution, escapement in 2004 is expected to be 234 and 336 for the North Fork and South Fork Nooksack early Chinook populations, respectively. Escapements in 2004 are anticipated to be above their respective critical escapement thresholds and above the viable escapement threshold for the management unit. Canadian fisheries are anticipated to account for 71 percent of the total exploitation rate on the Nooksack early Chinook Management Unit in 2004. Seventy-four percent of the southern U.S. fishing-related mortality is anticipated to occur in tribal fisheries in 2004 (FRAM 2004).

Skagit Springs - The 1999 to 2002 escapements have averaged 380, 364 and 330 adult spawners for the

Suiattle, Upper Sauk and Upper Cascade spring Chinook populations in the Skagit River system. The Suiattle and Upper Sauk average escapements are near or above their viable escapement thresholds[7] of 400 and 330, respectively. The Upper Cascade River has exhibited increased escapements since listing and escapement in the Suiattle and Upper Sauk has been stable (Table 4). Escapements in 2004 are expected to be 433, 406, and 344 adult spawners (Table 18) for the Suiattle, Upper Sauk and Upper Cascade populations, respectively. The anticipated 2004 escapements are above the viable escapement thresholds for the Suiattle and Upper Sauk populations. The anticipated exploitation on the Skagit spring Chinook Management Unit in 2004 is 33 percent, below the RER of 38 percent. Canadian fisheries are anticipated to account for 47 percent of the total exploitation rate on the Skagit spring Chinook Management Unit in 2004 (FRAM 2004).

White River - The 1999 to 2002 average escapement of 1,220 adult spawners for the White River population is above the viable escapement threshold of 1,000 fish and the population has exhibited an increasing escapement trend since listing (Table 4). The anticipated total exploitation rate in 2004 is 19 percent, resulting in an expected escapement of 1,705 adult spawners (Table 18), above the viable escapement threshold of 1,000 adult spawners. Canadian fisheries are anticipated to account for 5 percent of the total exploitation rate on the White River spring Chinook population in 2004 (FRAM 2004).

Dungeness River - The 1999 to 2002 average escapement of 345 adults for the Dungeness River population is above the VSP-derived critical escapement threshold of 200 fish, but below the viable escapement threshold of 925 adult spawners. The anticipated escapement in 2004 of 461 adult spawners, while still well below the viable escapement threshold is above the recent years' average escapement and the population has exhibited an increasing escapement trend since listing (Table 4). Southern U.S. fisheries are expected to account for a small proportion of the total fishing-related mortality on the Dungeness spring Chinook population in 2004. The anticipated 2004 exploitation rate on the Dungeness Management Unit is 4 percent in Puget Sound, 5 percent in southern U.S. fisheries and 24 percent in total (Table 17). Canadian fisheries are anticipated to account for 69 percent of the total exploitation rate on the Dungeness Management Unit in 2004 (FRAM 2004).

For Puget Sound summer and fall-type populations, to date, RERs have been developed for populations in the Skagit[8], Snohomish, Stillaguamish, and Duwamish-Green River Chinook salmon management units. The total anticipated exploitation rates in 2004 (including Alaskan and Canadian fisheries) are anticipated to be below the RERs for the Skagit and Stillaguamish Chinook salmon populations (Table 17). Southern U.S. exploitation rates are below the RERs for the Snohomish and Duwamish-Green Chinook salmon populations, but when added to the mortality that is projected to occur in Alaskan and Canadian fisheries in 2004, the total exploitation rates of 29 and 62 percent exceed the RERs of 18 and

[7]A viable escapement threshold has not yet been identified for the Upper Cascade population but it is likely similar to the viable thresholds for the other two Skagit spring Chinook populations (Skagit Rebuilding Exploitation Rate Workgroup 2003).

[8]Although RERs have not been established for the Upper Cascade spring or Snoqualmie Chinook populations, ancillary information indicated that the RERs developed for other populoations within their management units should be protective of these populations (Skagit Rebuilding Exploitation Rate Workgroup 2003).

53 percent for the Snohomish and Duwamish-Green populations, respectively (Table 17).

In general, Puget Sound summer and fall Chinook salmon escapements are expected to remain stable or continue to increase in 2004 when compared with recent year average escapement (Table 18). In addition, Chinook populations in seven of the ten Puget Sound Chinook summer/fall management units (Skagit, Snohomish, Stillaguamish, Duwamish-Green, Puyallup, Nisqually and Skokomish) are expected to exceed their viable escapement thresholds in 2004 and approach or exceed their post-listing averages (Table 18).

Skagit River summer/fall Chinook - The NMFS-derived RERs are 49, 51 and 60 percent for the Lower Skagit, Lower Sauk and Upper Skagit populations, respectively. The anticipated exploitation rates in 2004 for the Skagit summer/fall Chinook Management Unit are 6 percent in Puget Sound and 7 percent in all southern U.S. fisheries. The total exploitation rate in 2004 for the Skagit summer/fall Chinook Management Unit is expected to be 38 percent, below the RERs for all three populations. Seventy-one percent of the fishing-related mortality on the Skagit summer/fall Chinook Management Unit is expected to be taken in Canadian fisheries (FRAM 2004).

All three populations in the Skagit summer/fall Management Unit have exhibited increasing escapement trends since listing (Table 4). The 1999 to 2002 average escapements for all three populations are above their viable escapement thresholds (Table 4). The anticipated escapements in 2004 are 16,182, 2,870, and 877 for the Upper Skagit, Lower Skagit and Lower Sauk populations, respectively, above their viable escapement thresholds (Table 18).

Stillaguamish River - The NMFS-derived RERs are 32 and 24 percent for the North and South Fork Stillaguamish populations, respectively. The anticipated exploitation rates in 2004 for the Stillaguamish Chinook Management Unit are 8 percent in Puget Sound and 9 percent in all southern U.S. fisheries. The total exploitation rate in 2004 for the Stillaguamish Chinook management unit is expected to be 23 percent (Table 17), below both RERs. Fifty-eight percent of the fishing-related mortality on the Stillaguamish Chinook Management Unit is expected to be taken in Canadian fisheries (FRAM 2004).

The North Fork Stillaguamish population escapement is considered increasing and the South Fork Stillaguamish population stable since listing (Table 4). The 1999 to 2002 average escapement of 697 natural-origin adult spawners in the North Fork Stillaguamish is above its viable escapement threshold of 552 adult spawners (Table 18). The 1999 to 2002 average escapement of 283 adult natural-origin spawners for the South Fork Stillaguamish population is above its critical escapement threshold of 200 fish, but below its viable escapement threshold of 300 fish (Table 18). The anticipated escapements in 2004 of 1,537 and 354 adult spawners for the North and South Fork Stillaguamish populations, respectively, are both above their recent years' average escapements and above their viable escapement thresholds (Table 18).

Snohomish River - The NMFS-derived rebuilding exploitation rate for the Snohomish River Chinook Management Unit is 18 percent, based on data from the Skykomish population. The anticipated exploitation rates in 2004 for the Snohomish Management Unit are 12 percent in Puget Sound and 13 percent in all southern U.S. fisheries. The total exploitation rate in 2004 for the Snohomish Chinook Management Unit is expected to be 29 percent which exceeds the RER. Fifty-three percent of the fishing-related mortality on the Snohomish Chinook Management Unit is expected to be taken in Canadian fisheries.

Both populations in the Snohomish Chinook Management Unit have exhibited an increasing escapement trend since listing (Table 4). The 1999 to 2002 average escapement of 2,118 for the Skykomish River population has been above the critical escapement threshold of 1,650 fish, but below the viable escapement threshold of 3,500 adult spawners (Table 18). The 1999 to 2002 average escapement of 1,818 fish for the Snoqualmie River population has been above the VSP guidance for a viable escapement threshold of 1,250 fish (Table 18). The anticipated escapements in 2004 of 4,351 and 4,990 adult spawners for the Skykomish and Snoqualmie populations, respectively, are both above the recent years' average escapements and above the viable escapement thresholds of 3,500 and 1,250 for the Skykomish and Snoqualmie populations, respectively (Table 18).

Lake Washington - The 1999 to 2002 average escapement is 385 for the Cedar River population and 373 for the Sammamish River population (Table 4). Since 1998, the natural escapements for both of these populations have exceeded the critical escapement threshold of 200 fish, but are well below the VSP-derived guidance for viable escapement thresholds of 1,250 fish for each population. Since listing, the escapement for the Cedar River population is considered stable, while the Sammamish River population is considered increasing (Table 4). The anticipated escapement for the Cedar River in 2004 is 414 (Table 18); above the critical escapement threshold of 200 and the recent year average escapement of 385, but well below the viable escapement threshold of 1,250. Projected 2004 escapement for the Sammamish population is not available, but escapement in recent years has averaged 373, similar to that of the Cedar River (Table 4). Escapements in individual years have been quite variable.

Total escapement estimates for the Cedar River population are based on an expansion of a live count of fish. However, Cedar River redd counts in recent years suggests that this expansion of the live count may be an underestimate of the total escapement (personal communication with P. Hage, Muckleshoot Tribe, February 10, 2004 and S. Foley, WDFW, February 19, 2004). Additionally, escapement estimates presented in Table 5 for the Sammamish River population do not include escapement into Upper Cottage Lake or Issaquah Creeks. Therefore, although the escapement information presented in Table 5 is believed to be representative of the populations' escapement trends, direct comparison of escapements with the VSP generic guidance for a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

The anticipated exploitation rates for the Lake Washington Management Unit in 2004 are 15 percent in Puget Sound salmon fisheries, 18 percent in southern U.S. fisheries and 43 percent across all fisheries (Table 17). Fifty-six percent of the salmon fishery-related mortality is expected to occur in Canadian fisheries. Since the Cedar River and Sammamish River populations share the same terminal fisheries, terminal conservation management measures directed at migrating fish returning to the Cedar River should also benefit fish returning to the Sammamish River. Terminal area fisheries for sockeye and coho salmon will be managed to minimize incidental impacts on Chinook salmon as long as the Cedar River population remains below the co-managers' upper management threshold of 1,200 fish (WDFW/PSIT 2004). Terminal fishery conservation management measures include Chinook salmon non-retention in recreational and commercial fisheries, no directed Chinook salmon fisheries, and the reduction in incidental impacts on Chinook salmon by other fisheries through time and area restrictions (WDFW/PSIT 2004).

Duwamish-Green -The NMFS-derived rebuilding exploitation rate for the Duwamish-Green population is 53 percent. The anticipated exploitation rates in 2004 for the Duwamish-Green Management Unit are

34 percent in Puget Sound and 37 percent in all southern U.S. fisheries. The total exploitation rate in 2004 for the Duwamish-Green Chinook Management Unit is expected to be 62 percent, above the RER. Thirty-nine percent of the fishing-related mortality for this population is expected to occur in Canadian fisheries. The terminal fisheries for the Duwamish-Green population will be managed inseason to meet the co-managers' escapement goal of 5,800 using inseason abundance updates. If the in-season abundance estimate indicates that the escapement goals will not be achieved with scheduled or proposed terminal area fisheries, the co-managers will constrain fisheries with the objective of increasing abundance to a level at or above the escapement objective (WDFW/PSIT 2004).

The co-managers' escapement goal of 5,800 naturally spawning adults (hatchery- and natural-origin) for the Duwamish-Green River population has been successfully achieved by the co-managers annually since 1995 (Table 5) and is above the NMFS-derived viable escapement threshold for this population of 5,523 adults (Table 4), although many are probably of hatchery-origin. The Duwamish-Green River population has exhibited an increasing escapement trend since listing (see Table 4). The 1999 to 2002 average escapement of 9,299 for the Duwamish-Green River population is above the viable threshold of 5,523 adults (Table 4) and the 2004 escapement (5,898) is anticipated to remain above the viable threshold. With the level of escapement anticipated to continue to exceed the NMFS-derived viable threshold, the level of risk to the Duwamish-Green River population that is associated with the anticipated 2004 exploitation rate is considered low.

Nisqually River - The 1999 to 2002 average escapement of 1,318 for the Nisqually River population is above the viable escapement threshold of 1,100 adult spawners and the population has exhibited an increasing escapement trend since listing (Table 4). Since the co-managers began to manage for a natural in-river escapement goal (1,100), the co-managers have successfully achieved the viable escapement threshold in the Nisqually River in all but one year (Table 5). In 2001, the estimated natural spawning escapement in the Nisqually River was 1,079 fish, only slightly below the escapement goal. The 2004 escapement (2,079) is anticipated to remain above the viable threshold (Table 18).

The anticipated exploitation rates for the Nisqually Chinook Management Unit in 2004 are 59 percent in Puget Sound salmon fisheries, 62 percent in southern U.S. fisheries and 76 percent across all fisheries (Table 18). Seventeen percent of the salmon fishery-related mortality is expected to occur in Canadian fisheries (FRAM 2004). The Nisqually Management Unit's terminal area fisheries will be managed based on an in-season run-size abundance update, which is designed to achieve the viable escapement threshold of 1,100 naturally spawning adults (WDFW/PSIT 2004). Should the in-season run-size abundance estimate indicate that the threshold of 1,100 fish will not be achieved with scheduled or proposed terminal area fisheries, the co-managers will constrain the fisheries with the objective of increasing abundance to a level at or above the escapement objective (WDFW/PSIT 2004).

Puyallup River - The 1999 to 2002 average escapement of 1,672 fish for the Puyallup River population has been above the viable threshold of 1,200 adults (Table 18). Using the trend in the South Prairie Creek index area as a proxy, the Puyallup River population is considered to have a stable escapement trend since listing (Table 4). The anticipated escapement of the Puyallup Chinook population in 2004 is 2,149 adult spawners (Table 18) which is above the viable escapement threshold and the recent years' average escapement. The anticipated exploitation rate in 2004 for the Puyallup Chinook Management Unit is 23 percent in Puget Sound, 26 percent in southern U.S. fisheries and 50 percent in for all fisheries (Table 17).

Mid-Hood Canal Rivers - Since 1990, escapements to the natural spawning areas in Mid-Hood Canal have exceeded the critical escapement threshold of 200 fish for this management unit in five years for which escapement estimates are available (Table 5). In 2002, the natural escapement into the Mid-Hood Canal Management Unit of 95 spawners was well below the VSP guidance for a critical escapement threshold of 200 fish. The 1999 to 2002 average escapement of 404 for the Mid-Hood Canal Management Unit is above the critical escapement threshold of 200 fish, but well below the VSP-derived viable escapement threshold of 1,250 spawning adults (Table 18). Since listing, the Mid-Hood Canal Rivers population has exhibited an increasing escapement trend (Table 4), although trends in its component tributaries of the population are varied (Table 5). The anticipated escapement in 2004 for the Mid-Hood Canal River Chinook population is 298, above the critical escapement threshold of 200 adult spawners, but well below the viable escapement threshold of 1,250 and the recent years' average escapement of 404.

Although, the Mid-Hood Canal Management Unit has exhibited an increasing escapement trend since listing, escapement trends in the individual rivers comprising the Mid-Hood Canal Rivers population have not varied uniformly. In recent years, the spawning aggregation in the Hamma Hamma River has generally accounted for the majority of the Mid-Hood Canal tributaries population. In comparison, the Dosewallips River has seen a decrease in escapement during this same time period. Spawning levels below 40 fish have been observed in recent years in the Duckabush and Dosewallips Rivers. However, exchange among the three spawning aggregations within the Mid-Hood Canal Management Unit, and with other Hood Canal natural and hatchery populations is probable (personal communication with W. Beattie, Northwest Indian Fisheries Commission, January 31, 2004), providing some buffer to the potential demographic risks to the Mid-Hood Canal Rivers population from very low escapements in its component tributaries.

The anticipated exploitation rates for the Mid-Hood Canal Management Unit in 2004 are 8 percent in Puget Sound salmon fisheries, 11 percent in all southern U.S. salmon fisheries and 31 percent overall (Table 17). Canadian fisheries are anticipated to account for 61 percent of the salmon fishery related mortality in 2004 (FRAM 2004). Since most harvest impacts to this population occur outside Hood Canal, it is difficult for the co-managers to impose differential terminal harvest regimes on the individual spawning aggregate components in order to adjust spawning distribution among the tributaries (W. Beattie, NWIFC, e-mail to K. Schultz, NMFS, January 31, 2004). Consistent with the proposed 2004-2009 RMP, in circumstances when escapement is projected to fall below the co-managers' low abundance threshold of 400 fish, the co-managers have implemented additional conservation measures in pre-terminal and terminal fisheries to reduce mortality including chinook salmon non-retention, no directed chinook salmon fisheries, and the reduction in incidental impacts to chinook salmon in other fisheries by the use of time and area restrictions (WDFW/PSIT 2004). To provide some perspective on the anticipated harvest on the component tributaries, eliminating all Puget Sound salmon fisheries would increase escapement to the Mid-Hood Canal Rivers population by at most 36 adults, from 298 to 334 adult spawners. Assuming 1999-2002 average escapement proportions among the three tributaries, escapement would increase by 24, 5 and 7 adults for the Hamma Hamma, Duckabush and Dosewallips, respectively.

Skokomish River - The 1999 to 2002 average natural spawning escapement of 1,483 fish for the Skokomish River population is above the VSP-derived viable escapement threshold of 1,250 adult spawners (Table 18). Since listing, the natural component of the Skokomish River population has exhibited an increasing escapement trend (Table 4). The anticipated natural in-river escapement in 2004

is 1,262, above the viable escapement threshold of 1,250 naturally spawning adults. The anticipated exploitation rates for the Skokomish salmon Chinook population in 2004 are 30 percent in Puget Sound salmon fisheries, 33 percent in southern U.S. salmon fisheries and 52 percent overall (Table 17). Canadian fisheries are anticipated to account for 36 percent of the salmon fishery related mortality in 2004 (FRAM 2004).

Elwha River - The 1999 to 2002 average escapement of 2,009 for the Elwha River population is below the viable escapement threshold of 2,900 adult spawners, but well above the critical escapement threshold of 200. The Elwha River population has exhibited a stable escapement trend since listing (Table 4). The anticipated escapement to the Elwha River in 2004 is 2,300 adult spawners, below the viable escapement threshold of 2,900 fish, but above the recent years' average escapement (Table 18).

Similar to the Dungeness Management Unit, southern U.S. fisheries are expected to account for a small proportion of the total fishing-related mortality on the Elwha Chinook population in 2004. The anticipated exploitation rate on the Elwha Management Unit is 4 percent in Puget Sound salmon fisheries, 5 percent in southern U.S. salmon fisheries and 24 percent in total (Table 17). Canadian fisheries are anticipated to account for 69 percent of the total exploitation rate on the Elwha Management Unit in 2004.

Table 18. **Projected 2004 escapements for Puget Sound Chinook populations compared with recent average escapements and escapement objectives** (FRAM 2004; personal communication with K. Rawson, Tulalip Tribe, April 13, 2004). Escapements expected to be above their viable thresholds are noted in bold type.

		Escapement		Escapement thresholds		
Management Unit	Population	Expected 2004	1999-2002 average	Critical	Viable	Co-manager Goal
Nooksack Early		**570**	429	400	500	
Skagit Spring		1,183	1,075			
	Suiattle	**433**	380	170	400	
	Upper Sauk	**406**	364	130	330	
	Upper Cascade	344	330	170		
Skagit Summer/Fall		19,929	13,810			
	Upper Skagit	**16,182**	10,144	967	7,454	
	Lower Skagit	**2,870**	2,944	200	2,182	
	Lower Sauk	**877**	721	251	681	
Stillaguamish		1,891	980			
	N. Fork Stillaguamish	**1,537**	697	300	552	
	S. Fork Stillaguamish	**354**	283	200	300	
Snohomish		9,341	3,936			
	Skykomish	**4,351**	2,118	1,650	3,500	
	Snoqualmie	4,990	1,818	400		
Duwamish-Green	**Duwamish-Green**	**5,898**	9,299	835	5,523	5,800
Lake Washington	**Cedar River**	414	385	200	1,250	
White River	**White River**	**1,705**	1,220	200	1,000	
Puyallup	**Puyallup**	**2,149**	1,672	200	1,200	
Nisqually	**Nisqually**	**2,079**	1,318	200	1,100	1,100
Mid-Hood Canal	**Mid-Canal Rivers**	298	404	200	1,250	
Skokomish	**Skokomish**	**1,262**	1,503	200	1,250	1,200
Dungeness	**Dungeness**	461	345	200	925	
Elwha	**Elwha**	2,310	2,009	200	2,900	

3.4.2 Cumulative Effects

Cumulative effects are those effects defined in 50 CFR 402.02. Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Non-Federal actions that require authorization under other sections of the ESA, and not included here, will be considered in separate section 7 consultations. Non-Federal actions such as actions taken by tribal, state and local governments will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area that encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative.

Representative State Actions - The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including developing and applying better habitat restoration, hatchery and harvest reforms, and water resource management. The following list of major efforts and programs, described in the Summer Chum Salmon Conservation Initiative (WDFW/PNPTC 2000), are directed at or are contributing to the recovery of Puget Sound salmon, including listed Puget Sound Chinook salmon:

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative
- Joint Wild Salmonid Policy
- 1994 - Hood Canal Coordinating Council
- Governor's Salmon Recovery Office
- Conservation Commission
- Salmon Recovery Lead Entities
- Salmon Recovery Funding Board Forest and Fish Report
- Growth Management Act

There are other proposals, rules, policies, initiatives, and government processes that help conserve marine resources in Puget Sound, improve the habitat of listed species, and assist in recovery planning. As with the above state initiatives, these programs could benefit the listed species if implemented and sustained.

In the past, Washington State's economy was heavily dependent on natural resources, with intense resource extraction activity occurring. Changes have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and substantial growth in other economic sectors. Growth in new businesses is creating urbanization pressures and has contributed to population growth and movement in the Puget Sound area, a trend likely to continue for the next few decades. Such trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly, and will increase the need for transportation, communication and other infrastructure development. These impacts will affect habitat features, such as water quality and quantity, that are important to the survival and recovery of the listed

species. The overall effect is likely to be negative, unless carefully planned and mitigated for through the initiatives and measures listed above.

Local Actions: Local governments will be faced with similar but more direct pressures from population increases and attendant activities. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time given the lack of certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat, allowing for development to destroy wetlands, stream-banks, estuarine shorelines, and other areas critical to listed species. This situation still applies, although a broad and gradual change in attitude towards planning may be occurring.

Some local government programs, if submitted for consideration, may qualify for limitation in the application of take prohibitions under the NMFS' ESA section 4(d) rule, which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will have few measurable positive effects on listed species and their habitat, and may even contribute to further degradation.

Tribal Actions: Tribal governments participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat and are expected to continue to do so. The results from changes in tribal forest and agriculture practices, water resource allocations, and land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

Private Actions: The effects of private actions on ESA-listed resources are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts.

Summary: Non-federal actions on listed species are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, the uncertainties associated with government and private actions, and the wide array of potential responses to changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although tribal, state, and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

3.5 Integration and Synthesis of Effects

Although populations are essential components of the structure and diversity of the ESU, it is the ESU, not any individual population, which is the listed entity under the ESA. The PSTRT is charged with identifying the biological characteristics of a recovered ESU as part of developing delisting criteria. These biological characteristics are based on the collective viability of the individual populations, their characteristics, and their distributions throughout the ESU. Using these ESU-wide population characteristics, NMFS, with assistance from the PSTRT, will assess whether the proposed fishery actions meet the biological viability criteria, broader regional goals for recovery, and NMFS' mandates under the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and federal trust responsibilities to treaty Indian tribes.

NMFS recognizes that there are various recovery scenarios that may lead to a recovered ESU. Different scenarios of ESU recovery may be based on choosing different degrees of acceptable risk of extinction for different combinations of populations across the ESU. An ESU-wide scenario with all populations at the lower end of the planning range for viability is unlikely to assure persistence and delisting of the ESU (PSTRT 2002). The final ESU-wide recovery plan, to be adopted under section 4(f) of the ESA, will likely include populations with a range of risk levels, but when considered in the aggregate, the collective risk will be sufficiently low to assure persistence of the ESU.

The geographical distribution of viable populations across the Puget Sound Chinook salmon ESU is important for the ESU's recovery (PSTRT 2002). The PSTRT identified five geographic regions (Figure 1) within the Puget Sound Chinook salmon ESU based on similarities in hydrographic, biogeographic, and geologic characteristics, which also correspond to regions where groups of populations could be affected similarly by catastrophes (volcanic events, earthquakes, oil spills, etc.). An ESU with well-distributed viable populations avoids the situation where populations succumb to the same catastrophic risk(s), allows for a greater potential source of diverse populations for recovery in a variety of environments (i.e., greater options for recovery), and will increase the likelihood of the ESU's survival in response to rapid environmental changes, such as a major earthquake. Geographically diverse populations in different regions also distribute the ecological and ecosystem services provided by salmon across the ESU.

The PSTRT recommends that an ESU-wide recovery scenario should include at least two to four viable Chinook salmon populations in each of the five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 2002). An ESU-wide recovery scenario should also include within each of these geographic regions one or more viable populations from each major genetic and life history group historically present within that geographic region (PSTRT 2002). While changes in harvest alone cannot recover the Puget Sound Chinook salmon ESU, NMFS can use the preliminary PSTRT guidance to assist it in evaluating whether the proposed action, in combination with fishing mortality in other fisheries, would impede recovery of the ESU.

The jeopardy determination in this biological opinion is based on consideration of the proposed management actions taken to reduce the catch of listed fish, the magnitude of the remaining harvest, particularly in comparison to the period of decline, and in some cases estimates of target exploitation rates which were derived to be consistent with survival and recovery, i.e., RERs. NMFS has also paid particular attention to the population structure within each region of the ESU by reviewing both the

status and impacts on components that were considered representative or important to each region and the ESU as a whole (Section 3.2). The jeopardy determination is based on quantitative assessments where possible and more qualitative considerations where necessary. Different methods and different types of information have been used for the various populations within the Puget Sound Chinook Salmon ESU, reflecting what was available or could be developed as part of this consultation. NMFS expects that more quantitative and holistic analyses and risk assessments will become available in time, and that standards may change as new information becomes available. In the meantime, NMFS must rely on the best available information in making its judgement about the risk of the proposed action to the listed species. Information provided in previous sections of this biological opinion is summarized in the following discussion by each of the major geographical regions identified by the PSTRT.

Strait of Georgia: There are two populations within the Strait of Georgia Strait: the North Fork Nooksack River and the South Fork Nooksack River early Chinook salmon populations. Both are classified as Category 1 populations. Straying between the two populations was historically low, as supported by available genetic data, but straying may have increased in recent years (PSTRT 2004a). Average escapement for both populations in this region has increased in recent years over pre-listing levels, although natural-origin escapement for both populations remain close to their critical escapement thresholds; and therefore, remain a cause for concern. Using the recent year average escapement distribution, escapement in 2004 is expected to be 234 and 336 for the North Fork and South Fork Nooksack early Chinook populations, respectively and 570 for the Nooksack early Chinook Management Unit. Escapements in 2004 are anticipated to be above the recent year average escapements, above their respective critical escapement thresholds and above the viable escapement threshold for the management unit. If naturally spawning hatchery-origin adults from the listed supplementation program are included, early Chinook salmon escapement has averaged 3,400 in the North Fork Nooksack in recent years, a 1000 percent increase since listing. Over the same period, natural-origin spawning Chinook adults have increased by only 11 percent.

When compared to hatchery-origin returns, the lack of a similar dramatic increase in natural-origin fish, given the substantial decreased in harvest rates over the same time, suggests natural-origin recruitment will not increase much beyond existing levels unless constraints limiting marine, freshwater, and estuary survival are alleviated. Augmentation of natural-origin spawners on the natural spawning areas of the North Fork Nooksack River, with the addition of hatchery-origin spawners, will continue to test the natural production potential of the system at higher escapement levels. The broodstock used for the Kendall Creek Hatchery program, located on the North Fork Nooksack River, retains the genetic characteristics of the original, donor, wild population and is considered essential for the survival and recovery of the ESU. Therefore, adult fish produced by the Kendall Creek Hatchery program and migrating with the natural-origin fish may buffer harvest-induced genetic and demographic risks to the natural-origin North Fork Nooksack River population.

The total exploitation rate on both populations has declined by 45 percent since the 1980's, averaging 74 percent from 1981 through 1984, and 41 percent for 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 9). The exploitation rate in 2004 in southern U.S. fisheries (6%), including Puget Sound fisheries, is well below the RER for the Nooksack early management unit, but the total ocean exploitation rate is expected to exceed the RER (Table 17). The RER for the Nooksack early management unit is not expected to be met in 2004, even with total closure of all southern U.S. fisheries. Natural origin escapement has increased since the ESU was listed and, in 2004, the Nooksack spring natural origin escapement is expected to exceed its viable

escapement threshold.

Similar to recent years, the majority of southern U.S. fishery harvest impacts on the Nooksack Management Unit populations in 2004 (74%) are expected to occur in treaty Indian fisheries. Since 2001, on average, 77 percent of the southern U.S. harvest on the Nooksack Management Unit has occurred in tribal fisheries. In recognition of treaty right stewardship, NMFS, as a matter of policy, has sought not to entirely eliminate tribal harvest. Instead, NMFS' approach is to accept some fisheries impacts that may potentially result in a slight increased risk to the listed species in order to provide limited tribal fishery opportunity (NMFS 2002b). This approach is taken in recognition that the treaty tribes have a right and priority to conduct their fisheries within the limits of conservation constraints. Because of the Federal government's trust responsibility to the tribes, NMFS is committed to considering the co-managers' judgment and expertise regarding conservation of trust resources. However, the opinion of the co-managers and their immediate interest in fishing is balanced against NMFS' responsibilities under the ESA.

Whidbey/Main Basin: The largest river systems in Puget Sound are found within the North Puget Sound Region. The ten Chinook salmon populations in this region are all Category 1 populations. Average escapements for eight of the ten populations in this region have increased above pre-listing levels and the other two are stable. Five of the ten populations in this region, including both spring and summer/fall life history types, are currently above their viable escapement thresholds, two are approaching their viable escapement threshold and one is below its viable threshold but well above its critical escapement threshold (Table 18). Data is not sufficient to derive viable thresholds for the Upper Cascade River in the Skagit spring management unit or the Snoqualmie River population in the Snohomish management unit. However, both populations are above their critical escapement thresholds (Table 18). Escapements in 2004 are expected to exceed recent year average escapements for nine of the ten populations, and exceed viable escapement thresholds for all eight populations for which they have been derived.

Exploitation rates have fallen 43 to 49 percent from levels in excess of 60 percent during the mid-1980s, to an average in recent years of 23 to 42 percent depending on the population (FRAM 2003; personal communication with D. Simmons, NMFS, April 1, 2004)(Tables 10,12 and 16). NMFS has determined that the proposed 2004 fisheries will meet RERs for eight of the ten populations (80 percent) within this region. The total exploitation rate for the Snohomish management unit is expected to exceed its RER in 2004, primarily due to harvest in Canadian fisheries. However, natural-origin escapement in the Skykomish River has exhibited an increasing escapement trend since listing and is expected to exceed its viable escapement threshold in 2004. In fact, the expected escapement in 2004, if realized, would be the highest in the database.

Southern Basin: There are six populations delineated by the PSTRT within the South Puget Sound Region (Figure 1). In this region, the Cedar and Duwamish-Green River fall Chinook salmon populations and White River spring Chinook salmon population are Category 1 populations. The Sammamish, Puyallup and Nisqually River Chinook are Category 2 populations. Genetically, most of the present spawning aggregations in the South Puget Sound Region are similar, likely reflecting the extensive influence of transplanted stock hatchery releases, primarily from the Green River population (PSTRT 2004a). The fall Chinook salmon populations in the South Puget Sound Region also have similar life history traits. The Puyallup and Nisqually systems were managed for hatchery harvest rates for decades. Beginning in 2000, management transitioned in the Nisqually and Puyallup systems from a

focus on hatchery management to management objectives based on naturally spawning adults. Average escapements for four (both spring and fall types) of the six populations in this region are above pre-listing levels (Sammamish, Duwamish-Green, White, Nisqually) and both long and short term trends in escapement for all populations have generally been positive. Escapements for four of the six populations in this region have exceeded viable escapement thresholds in recent years (Duwamish-Green, White, Puyallup, Nisqually) and are expected to do so again in 2004 (Table 18).

The proposed Puget Sound fisheries in 2004 are anticipated to contribute to the stabilization or rebuilding of all populations within this region[9]. However, NMFS has identified a concern for two South Puget Sound Region populations (Cedar River and Sammamish River) due primarily to anticipated low abundance and the level of volatility that has been observed in past escapements. Escapements for both the Cedar and Sammamish Chinook populations have exceeded their critical thresholds since 1998, but are well below their viable thresholds (Table 18). Escapement to the Cedar is considered stable while escapement to the Sammamish is increasing. However, since the escapements are based on partial census of the populations, the escapement estimates should be considered conservative as the total escapements for these two systems are likely greater. Because both populations are affected by the same terminal fisheries, NMFS expects that protective measures imposed to safeguard the Cedar River population will also incidentally benefit the Sammamish River population. Noteworthy limiting factors in the Lake Washington basin are being addressed by improving passage conditions for salmon at the Ballard Locks, in addition to recently restored anadromous fish access to 12 miles of Cedar River. While these improvements will likely enhance spatial structure and productivity, there remain highly altered conditions in the Lake Washington basin and at the Ballard Locks that are daunting to juvenile emigration and adult immigration.

Past strategies to maximize harvest of hatchery stocks resulted in exploitation rates of 80 percent or more. Total exploitation rates have declined by 14 to 63 percent since the early 1980s, averaging 29 to 77 percent in recent years, depending on the population (FRAM 2003). The expected exploitation rate for the Duwamish-Green Chinook population in Puget Sound salmon fisheries is expected to be 34 percent, well below the RER of 53 percent, but, when added to the expected ocean exploitation rates, the projected 2004 total exploitation rate is expected to exceed the RER for the Duwamish-Green Chinook population (63%). However, escapement in 2004 is expected to remain above the viable escapement threshold of 5,523.

Hood Canal: The Skokomish and Mid-Hood Canal Tributaries populations are both Category 2 type populations. Category 2 watersheds are areas where indigenous populations are believed to no longer exist, but where sustainable wild populations existed historically and wild production is self-sustaining at present. Average recent years escapement for both populations have increased above pre-listing levels (Table 4). The Skokomish River escapement has been near or above its viable escapement threshold in four of the last five years (Tables 5) and is expected to exceed its viable threshold in 2004 (1,262 naturally spawning adults) (Table 18).

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[9]With the level of escapement for the Duwamish-Green River population anticipated to continue to exceed the NMFS-derived viable threshold, the level of risk to this population associated with implementation of the proposed 2004 Puget Sound salmon fisheries is low. However, it should be noted that hatchery-origin adults are believed to contribute substantially to the naturally spawning adults.

There is a potential concern for harvest impacts to the spatial structure of the Mid-Hood Canal Rivers population. This concern is heightened because of the low abundance in two of the individual tributaries. The 1999 to 2002 average escapement of 404 fish for the Mid-Hood Canal tributaries population is above the critical escapement threshold of 200, but well below the viable escapement threshold of 1,250 fish (see Table 18). The Mid-Hood Canal Rivers population has exhibited an increasing escapement trend since listing (see Table 4). However, the expected escapement in 2004 for the Mid-Hood Canal Rivers Chinook salmon population is 298, relatively close to the critical escapement level and lower than the recent years' average.

The Mid-Hood Canal Rivers population includes spawning aggregations in the Hamma Hamma, Duckabush, and the Dosewallips Rivers. Escapement into the individual systems has varied, with the spawning aggregation in the Hamma Hamma River representing the majority of the total Mid-Hood Canal tributaries population abundance in recent years. Adult returns resulting from the Hamma Hamma River supplementation program, which relies partially on broodstock returning to the river, has contributed substantially to the Mid-Hood Canal tributaries population's increasing abundance trend. In 2002, the natural escapement of 95 spawners into the Mid-Hood Canal Management Unit fell well below the VSP guidance for a critical threshold of 200 fish for this population. Spawning aggregations below 40 fish have been observed in recent years in the Duckabush and Dosewallips Rivers.

Since most harvest impacts to this population occur outside Hood Canal, it is difficult for the co-managers to impose differential terminal harvest regimes on the individual spawning aggregate components in order to adjust spawning distribution among the tributaries. Even with no Puget Sound fisheries, anticipated escapement into the Mid-Hood Canal tributaries population would increase by an estimated 36 spawning adults, spread among the three component natural spawning rivers. Given the ratio of recent year escapements into the individual river systems in the Mid-Hood Canal Management Unit, escapement would increase by 24, 5 and 7 adults for the Hamma Hamma, Duckabush and Dosewallips, respectively. Based on this modeling, there is little effect further decreases in the proposed Puget Sound fisheries-related impacts would have on the persistence of the spawning aggregations in the Dosewallips and Duckabush Rivers. The co-managers have implemented additional conservation measures in pre-terminal and terminal fisheries to reduce mortality including non-retention, no directed fisheries, and reduction in incidental impacts in other fisheries by the use of time and area restrictions (WDFW/PSIT 2004).

The hatchery-origin production derived from broodstock returning to the Hamma Hamma River may buffer demographic risks to the Mid-Hood Canal tributaries population in the short term, particularly to the component of the population spawning in the Hamma Hamma River. The characteristics of the Mid-Hood Canal tributaries population, including life history and run timing, are also found in the Skokomish River population, the only other population within the region. Genetically similar stocks are also sustained by several hatchery facilities in the Hood Canal area and in hatcheries in the South Puget Sound Region where the Green River-linage are naturally or artificially sustained.

The overall exploitation rate for Hood Canal summer-fall Chinook salmon declined by 49 percent since the early 1990s, averaging 87 percent from 1985 through 1990 brood years, and 44 percent from 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 14). The anticipated exploitation rates for the Skokomish salmon Chinook population in 2004 are 33 percent in southern U.S. salmon fisheries and 52 percent overall. Canadian fisheries are anticipated to account for 37 percent of the salmon fishery related mortality in 2004 on the Skokomish Chinook

salmon Management Unit (FRAM 2004). The anticipated exploitation rates for the Mid-Hood Canal Management Unit in 2004 are 11 percent in southern U.S. salmon fisheries and 31 percent overall (Table 17). Canadian fisheries are anticipated to account for 61 percent of the salmon fishery-related mortality (FRAM 2004). Further decrease in the Puget Sound fisheries-related impacts would have little practical effect on the persistence of the Mid-Hood Canal Rivers population, resulting in an estimated additional 5 spawning adults to the Duckabush River and 7 to the Dosewallips River.

Strait of Juan de Fuca: There are two populations within this region: the Elwha, a fall timed population, and the Dungeness, a spring timed population. Both are classified as Category 1 populations. Recent years' average escapement for the Dungeness population is above pre-listing levels and above its critical escapement threshold, although well below its viable escapement threshold. The Elwha Chinook population is stable with a post-listing average escapement of 2,000 compared with a viable escapement threshold of 2,900 adults. Escapements in 2004 are expected to be 461 and 2,310 for the Dungeness and Elwha populations, respectively. Both expected escapements are above recent years' averages.

Exploitation rates have declined by 59 percent on average, from 76 percent in the 1980s to 31 percent in recent years (FRAM 2003). The expected exploitation rate in Puget Sound salmon fisheries is 4 percent with a total exploitation rates (including Alaskan and Canadian fisheries) of 24 percent. Anticipated southern U.S. exploitation rates are low (5%) and further reductions would have little practical effect on the persistence of these two populations. Canadian fisheries are anticipated to account for 69 percent of the total exploitation rate on the Dungeness and Elwha populations in 2004.

The hatchery-origin production operating in the two watersheds within this region share the ecological and genetic traits of the natural-origin populations and is considered essential to recovery of the ESU. Considering the current level of degradation in habitat quality and quantity, the populations would likely have gone extinct without the continued contribution of the hatchery programs.

The PSTRT identified five geographic regions within the Puget Sound Chinook salmon ESU and recommended that an ESU-wide recovery scenario should include at least two to four viable Chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 2002). The information summarized above suggests that conduct of the 2004 Puget Sound salmon fisheries will have little to no effect on the ability to achieve viability criteria for at least two to four populations in each major Puget Sound geographic region, representing the range of life history types within that region (Table 19).

Table 19. Summary of 2004 expectations by major geographic region and life history type in the Puget Sound Chinook Salmon ESU.

Geographic Region	Number of populations	Life History	Escapement Thresholds		Stable or above ave. pre-listing escapement	Number of RERs met
			Critical	Viable		
(1) Strait of Georgia	2	spring	1/2	1/1*	2/2	0/1
(2) Whidbey/Main Basin	3	spring	3/3	2/2	3/3	2/2
	5	fall summer	3/3 2/2	3/3 2/2	3/3 2/2	3/3 2/2
	2	summer/fall	2/2	1/1	2/2	0/1
(3) Southern Basin	5	fall	5/5	3/5	5/5	0/1
	1	spring	1/1	1/1	1/1	NA
(4) Hood Canal	2	fall	2/2	1/2	2/2	NA
(5) Strait of Juan de Fuca	1	fall	1/1	0/1	1/1	NA
	1	spring	1/1	0/1	1/1	NA

* Exceeds viable escapement threshold for the management unit

3.6 Conclusion

The Puget Sound Chinook Salmon ESU includes 22 Chinook populations distributed over five distinct geographic areas and several life history types. Total exploitation rates have decreased 14 to 63 percent from rates in the 1980s. Puget Sound Chinook salmon escapements have been stable or increasing since the ESU was listed in 1999 for all populations in all regions and life history types, an apparent positive response to the decline in exploitation rates in combination with other factors. Recent years' average escapement for all but the North Fork Nooksack population is above the critical escapement thresholds and two or more of the populations in two of the five regions (10 populations over all regions) exceed the viable escapement thresholds, representing the range of life history types in each region.

All but one of the populations (North Fork Nooksack) in the ESU is expected to exceed its critical escapement threshold, and 14 of the 19 populations, representing 60% or more of the populations in three of the five ESU regions, are expected to be met or exceed their viable escapement thresholds (assuming current environmental conditions) under the harvest regime proposed in 2004. Although concerns remain regarding low abundance of two of the populations in the remaining two regions, analysis indicated conduct of the 2004 Puget Sound salmon fisheries will have little to no effect on the ability to achieve viability criteria in these regions. Seven of the ten RERs are expected to be met under the harvest regime proposed in 2004. Escapements for the three populations for which RERs are not expected to be met are expected to meet or exceed their viable escapement thresholds in 2004.

After reviewing the current status of the Puget Sound Chinook salmon ESU, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, it is NMFS' biological opinion that the proposed Puget Sound salmon fisheries in 2004 are not likely to jeopardize the continued existence of the Puget Sound Chinook Salmon ESU.

4 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and protective regulations adopted under section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the BIA and USFWS. These agencies have a continuing duty to regulate the activity covered by this incidental take statement in consultation with the affected states and tribes. If the agencies fail to assume and implement the terms and conditions of this incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of take, the BIA and USFWS, in consultation with the affected tribes and states, must document the progress of the action and its impact on the species as specified in the incidental take statement. [50CFR §402.14(i)(3)]

4.1 Amount or Extent of Incidental Take

For the purpose of this Incidental Take Statement, the extent of the incidental take of listed Puget Sound Chinook salmon from Puget Sound salmon fisheries, is the amount up to 1) the southern U.S. or total exploitation rates as modeled in FRAM model run 1604; or, 2) NMFS' rebuilding exploitation rates, as defined in Table 20. In the case of the Duwamish-Green, Nisqually and Skokomish Chinook Management Units, the authorized level of take is that number above their respective escapement goal defined in Table 20. Allowable take is defined this way so as to be responsive to varying run sizes.

4.2 Effect of the Take

In the accompanying biological opinion, NMFS determined that the level of anticipated take of the Puget Sound Chinook Salmon ESU in the proposed Puget Sound fisheries, as defined in Table 20, is not likely to jeopardize the continued existence of either listed species or result in destruction or adverse modification of critical habitat where designated.

Table 20. Allowable incidental take in terms of southern U.S. or total exploitation rates based on the preliminary pre-season FRAM model run 1604, NMFS' RERs or escapement goal by Puget Sound Chinook salmon management unit.

	Exploitation Rates			Co-manager Escapement Goal
Management Unit	2004 Total	2004 Southern U.S.	NMFS-derived RER	
Nooksack		5		
Skagit Spring			38	
Skagit Summer/Fall			49	
Stillaguamish			24	
Snohomish		12		
Lake Washington		15		
Duwamish-Green				5,800
White River	19			
Puyallup	50			
Nisqually				1,100
Mid-Hood Canal		8		
Skokomish				1,200
Dungeness		4		
Elwha		4		

4.3 Reasonable and Prudent Measures

There are two reasonable and prudent measures included in this incidental take statement for the ESUs considered in this opinion.

(1) In-season management actions taken during the course of the fisheries shall be consistent with the level of incidental take established preseason that were analyzed in the accompanying biological opinion (Table 20); and

(2) Harvest impacts of listed salmon stocks shall be monitored using best available measures.

To clarify the first measure, NMFS expects that in-season management actions may be taken in 2004 that may be different than those anticipated pre-season. However, NMFS analyzed impacts to listed

fish anticipated in 2004 against NMFS' RERs, viable and critical escapement thresholds and concluded they were not likely to jeopardize the listed species. Therefore, in-season management actions may be taken so long as they do not exceed the anticipated levels of take described in Table 20.

4.4 Terms and Conditions

In order to be exempt from the prohibitions of sections 9 and 4(d) of the ESA, the BIA and USFWS must comply with the following terms and conditions to implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The BIA and USFWS shall confer with the affected state and tribes, to ensure that in-season management actions taken during the course of the fisheries during the 2004 fishing season are consistent with the take specified in the effects section of the ITS above for the Puget Sound Chinook Salmon ESU.

2a. The BIA and USFWS shall confer with the affected states and tribes prior to the start of fishing each year to produce a summary table showing that the harvest targets and fishing regimes adopted preseason are consistent with the take expectations specified in Section 4.1 of the Incidental Take Statement (ITS) above for the Puget Sound Chinook Salmon ESU.

2b. The BIA and USFWS, in cooperation with the affected state and tribes, shall monitor the catch and implementation of other management measures during the 2004 fishing season, e.g., non-retention fisheries, at levels that are comparable to those used in recent years. The monitoring is to ensure full implementation of, and compliance with, management actions specified to control the various fisheries within the scope of the action.

2c. The BIA and USFWS, in cooperation with the affected state and tribes, shall sample the fisheries for stock composition during the 2004 fishing season, including the collection of CWTs in all fisheries and other biological information to allow for a thorough post-season analysis of fishery impacts on listed species.

2d. The BIA and USFWS shall confer with the affected states and tribes as appropriate, prior to the start of preseason planning to produce a summary table showing that the brood year exploitation rates and annual escapements for those Puget Sound Chinook salmon populations for which the data are available, as assessed post-season, are consistent with the take specified in Section 4.1 of the Incidental Take Statement above for the Puget Sound Chinook Salmon ESU.

2e. The BIA and USFWS in collaboration with the affected state and tribes shall continue to evaluate the impacts of selective and non-retention fishing techniques in commercial and recreational fisheries, where implemented, on listed species

5 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented by the BIA and USFWS.

1. The BIA and USFWS, in collaboration with the affected states and tribes should evaluate the ability of the listed Puget Sound Chinook Salmon ESU to survive and recover, given the totality of impacts affecting the ESU during all phases of the salmonid's life cycle, including freshwater, estuarine and ocean life stages. For this effort, the BIA and USFWS should collaborate with the affected co-managers to evaluate available life cycle models or initiate the development of life cycle models where needed.

2. The BIA and USFWS in collaboration with the affected states and tribes should evaluate where possible improvement in gear technologies and fishing techniques that would reduce mortality of listed species.

3. The BIA and USFWS in collaboration with the affected states and tribes should continue to evaluate the feasibility of selective and non-retention fishing techniques in commercial and recreational fisheries to reduce impacts on listed species without compromising data quality used to manage fisheries.

4. The BIA and USFWS in collaboration with the affected states and tribes should continue to improve the quality of information gathered on ocean rearing and migration patterns to improve the understanding of the utilization and importance of these areas to listed ESUs.

5. The BIA and USFWS in collaboration with the affected states and tribes should continue to evaluate the potential selective effects of fishing on the size, sex composition or age composition of salmon populations.

6 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed 2004 Puget Sound salmon fisheries as it relates to the Puget Sound Chinook Salmon ESU. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect on listed species or critical habitat that was not considered in the biological opinion; (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of take is exceeded, NMFS must immediately reinitiate formal section 7 consultation on the proposed fisheries. In the case of populations for which RERs are derived, a change in the rate itself will not be considered grounds for re-initiation as long as the rate is

consistent with the risk criteria used by NMFS described previously in this document (Subsection 3.4.1.1)

7 MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) provisions of the Magnuson-Stevens Act (MSA) require heightened consideration of fish habitat in resource management decisions. EFH is defined in section 3 of the MSA as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920(j) require that before a Federal agency may authorize, fund or carry out any action that may adversely effect EFH, it must consult with NMFS and, if requested, the appropriate Regional Fishery Management Council. The purpose of consultation is to develop a conservation recommendation that addresses all reasonably foreseeable adverse effects on EFH. Further, the action agency must provide a detailed response in writing to NMFS and the appropriate Council within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with conservation recommendations of NMFS, the agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

This consultation requirement does not distinguish between actions which occur within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and up slope activities that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by Federal agencies undertaking permitting or funding activities that may adversely affect EFH, whatever its location.

The objective of this EFH consultation is to determine whether the adoption of the proposed fishery management activities by NMFS may adversely affect EFH for any of the species for which EFH has been identified. If the proposed action is determined to be likely to adversely affect EFH, conservation recommendations will be recommended to avoid, minimize, or otherwise offset potential adverse impacts on EFH resulting from the proposed activities discussed in the biological opinion above.

7.1 Identification of Essential Fish Habitat

The Pacific Fisheries Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the MSA. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon and California, and recommends Pacific halibut harvest regulations to the International Pacific Halibut Commission.

Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) (PFMC 1999), EFH for five species of coastal pelagic species (PFMC 1998a), and a "composite" EFH for 62 species of groundfish (PFMC 1998b). The PFMC has not identified EFH for chum salmon (*Oncorhynchus keta*), but the areas used by chum for "spawning, breeding, feeding, or growth to maturity" overlap with those identified for

coho and Chinook salmon as encompassed by the actions considered in this consultation. For purposes of this consultation, marine EFH for Chinook and coho in Washington and Oregon includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho and California, except areas upstream of certain impassable barriers (i.e., natural waterfalls in existence for several hundred years). A description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects on these species' EFH from the proposed action is based, in part, on this information.

7.2 Proposed Action

The action area for this EFH consultation includes the marine and freshwater waters of Washington state from the mouth of the Strait of Juan de Fuca at Cape Flattery, eastward to the boundaries defined by the Puget Sound Chinook Salmon ESU.

The two Federal actions being considered in this consultation are: (1) programs administered by the BIA that support tribal salmon fisheries management programs in Puget Sound. Only administration of programs that affect listed Puget Sound Chinook salmon through April 30, 2005, are considered in this consultation, and (2) authorization of salmon fishing activities in Puget Sound by the USFWS as a party to the Hood Canal Salmon Management Plan. The federal, tribal and state parties to the HCSMP establish management objectives for populations originating in Hood Canal including listed Chinook populations. Management under the HCSMP affects those fisheries where Hood Canal salmon populations are caught. Only fisheries that may impact listed Puget Sound Chinook salmon through April 30, 2005 are considered in this consultation. Both Federal actions are described in more detail in subsection 3.1.1 of the ESA section 7 consultation above. The two actions have been grouped in this consultation because they are similar actions within a common geographical area.

7.3 Effects of the Proposed Action

The harvest-related activities of the proposed actions considered in this consultation involve boats using hook-and-line gear and commercial net gear. The use of these gears affects the water column and the shallower estuarine and freshwater substrates, rather than the deeper water, offshore habitats. The PFMC assessed the effects of fishing on salmon EFH and provided recommended conservation measures in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999).

The PFMC identified five types of impact on EFH : (1) gear effects; (2) harvest of prey species by commercial fisheries; (3) removal of salmon carcasses; (4) redd or juvenile fish disturbance; and (5) fishing vessel operation on habitat. Of the five types of impact on EFH identified by the PFMC for fisheries, the concern regarding gear-substrate interactions, removal of salmon carcasses, redd or juvenile fish disturbance and fishing vessel operation on habitat are also potential concerns for the salmon fisheries in Puget Sound.

(1) *Gear effects and fishing vessel operation (4)* - Possible fishery-related impacts on riparian vegetation and habitat would occur primarily through bank fishing, movement of boats and gear to the water, and other stream side usages. The types of salmon fishing gear that are used in Puget Sound

salmon fisheries in general actively avoid contact with the substrate because of the resultant interference with fishing and potential loss of gear. In addition, the proposed fishery implementation plan includes actions that would minimize these impacts, such as area closures (PSIT/WDFW 2004). Also these effects would occur to some degree through implementation of fisheries or activities other than the 2004 Puget Sound salmon fisheries, i.e., recreational boating and marine species fisheries. Construction activities directly related to salmon fisheries are limited to maintenance and repair of existing facilities (such as boat launches), and are not expected to result in any additional impacts on riparian habitats because of the 2004 fisheries. The facilities used in association with the fisheries are essentially all in place. Therefore, the 2004 fisheries would have a negligible additional impact on the physical environment.

(2) *Removal of salmon carcasses* - The PFMC conservation recommendation to address the concern regarding removal of salmon carcasses was to manage for maximum sustainable spawner escapement and implementation of management measures to prevent overfishing. Both of these conservation measures are basic principles of Puget Sound salmon management (PST 1999; Puget Sound Management Plan 1985). Therefore, management measures to minimize the effects of salmon carcass removal on EFH are an integral component of the management of the proposed 2004 fisheries.

(3) *Redd or juvenile fish disturbance* - Trampling of redds during fishing has the potential to cause high mortality of salmonids. Boat operation can result in stranding and mortality related to pressure changes in juveniles (PFMC 1999). The PFMC report recommended angler education and the closer of key spawning areas during the time that eggs and juvenile salmon were present. Salmon fisheries are closed or fishing activities do not occur in freshwater areas in Hood Canal, North Puget Sound and the Strait of Juan de Fuca during peak spawning, rearing and outmigration periods (personal communication with S. Theisfeld and T. Johnson, WDFW, May 12, 2004). Notices are posted near fishing access areas by WDFW and the Washington Parks Department, and news releases are distributed by WDFW before each fishing season explaining responsible fishing behaviour, including avoidance of spawning areas and damage to riparian areas (personal communication with T. Johnson, WDFW, May 12, 2004). The Puyallup and White River in South Puget Sound are closed to salmon fishing through much of chinook migration and spawning. These management measures should minimize redd or juvenile fish disturbance due to conduct of the 2004 Puget Sound salmon fisheries.

7.4 Conclusion

Management measures of the type recommended for EFH impacts identified in the PFMC assessment of fisheries and EFH have already been implemented as part of the proposed 2004 fishing regime. Therefore, the proposed Federal action would not adversely affect designated EFH for Chinook salmon within the action area.

7.5 EFH Conservation Recommendation

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. However, because NMFS concluded that the proposed 2004 Puget Sound salmon fisheries would not adversely affect the EFH, no additional conservation recommendations are needed.

7.6 Statutory Response Requirement

Because there are no additional conservation recommendations, there are no statutory response requirements.

7.7 Consultation Renewal

NMFS must re-initiate EFH consultation if plans for this action are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR §600.920(k)).

8 SECTION 515 PRE-DISSEMINATION REVIEW & DOCUMENTATION

Section 515 directs the Office of Budget and Management to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." The Office of Management and Budget in turn issued guidelines that required federal agencies to 1) develop their own guidelines; 2) provide a process for people to ask for and obtain corrected information that is found not to comply with section 515 or agency guidelines; and 3) keep track of the complaints about the accuracy of information and how they were handled. The following documents the basis, data standards, review and distribution of the biological opinion.

Information Product Category: Natural Resource Plan

Medium of distribution: Individual copies were provided electronically and in hard copy to the Bureau of Indian Affairs (BIA) and the U.S. Fish and Wildlife Service, electronically to the Washington Department of Fish and Wildlife (WDFW), and NW Indian Fisheries Commission. May be posted on the NMFS NW Region web site.

Utility of Biological Opinion

Consultation by Federal agencies with NMFS is required under section 7 of the ESA whenever a Federal agency approves, funds or carries out an action that might affect a listed species. This consultation was required under the ESA to determine whether the Puget Sound salmon fisheries would appreciably reduce the survival and recovery, i.e., jeopardize, of the affected ESUs before the BIA could proceed with administration of tribal fishery management programs or the USFWS with approval of fishing activities involving the 2004 Puget Sound salmon fisheries. Supplying copies of the document to the management agencies provides them with the documentation that NMFS has determined that the proposed fisheries will not jeopardize the continued existence of the affected ESUs. Providing copies to WDFW and the NWIFC is consistent with their roles as fishery managers for the affected ESUs and with NMFS' obligations under Secretarial Order 3206 (Department of Interior Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the Endangered Species Act).

Integrity of Biological Opinion

The documents in this regulatory package are managed by NMFS on a computer network in accordance with relevant IT security policies and regulations such as the standards set out in Appendix III, "Security of Automated Information Resources", OMB Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity of Biological Opinion

Standards. This consultation and supporting documents adhere to published standards including:

1. ESA Consultation Handbook
2. ESA Regulations, 50 CFR 402.01 et seq.
3. Magnuson-Stevens Act implementing regulations regarding EFH, 50 CFR

600.920(j)

Best Available Information. This consultation and supporting documents use the best available information. More information on the information used is contained in the biological opinion and the analytical documents referenced in the ESA section 7 and EFH consultations.

Transparency. Policy choices are clearly distinguished from the supporting science. Supporting materials, information, data, and analyses are referenced to ensure transparency.

Review of Biological Opinion

Review Process. This document has been drafted and reviewed by staff with training in ESA and Magnuson-Stevens Act implementation. Legal review has been performed for consistency with applicable law, including the ESA.

Pre-dissemination Review: Pursuant to Section 515 of Public Law 106-554 (the Data Quality Act,) this product has undergone a pre-dissemination review.

9 REFERENCES

Beamish, R.J., and D.R. Bouillon. 1993. Pacific salmon production trends in relation to climate. Can. J. Fish. Aquat. Sci. 50:1002-1016.

Beamish, R.J., D.J. Noakes, G.A. MacFarlane, L. Klyshatorin, V.V. Ivanov, and V. Kurashov. 1999. The regime concept and natural trends in the production of Pacific salmon. Can. J. Fish. Aquat. Sci. 56:516-526.

Beattie, W. Conservation Planning Coordinator, Northwest Indian Fisheries Commission, January 31, 2004. Personal communication, e-mail to Keith Schultz (NMFS NWR Sustainable Fisheries Division), regarding straying among Hood Canal chinook populations, and escapement estimation and harvest management of Puget Sound chinook populations..

Bishop, S. and A. Morgan (eds.). 1996. Critical habitat issues by basin for natural chinook salmon stocks in the coastal and Puget Sound areas of Washington State. Northwest Indian Fisheries Commission, Olympia, WA, 105 p. (Available from Northwest Indian Fisheries Commission, 6730 Martin Way, E., Olympia, WA 98506).

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261p.

Chinook Technical Committee of the Pacific Salmon Commission (CTC). 2003. Annual exploitation rate analysis and model calibration (TCChinook (03)-2). Pacific Salmon Commission. Vancouver, B.C. November 28, 2003. 55 pp. + Appendices.

Cramer, S.P., J. Norris, P. Mundy, G. Grette, K. O'Neal, J. Hogle, C. Steward, and P. Bahls. Status of chinook salmon and their habitat in Puget Sound. Volume 2, Final Report. June 1999.

Craig, J.A., and R.L. Hacker. 1940. The history and development of the fisheries of the Columbia River. Bulletin of the Bureau of Fisheries Vol. XLIX. Bulletin No. 32.

Department of Ecology (DOE). 2004. 2002-2004 proposed assessment- Category 5- the 303(d) list, at http://www.ecy.wa.gov/programs/wq/303d/2002/2002_list.html. Web site accessed May 10, 2004.

Doppelt, B., M. Scurlock, C. Frissell, and J. Karr. 1993. Entering the watershed: a new approach to save America's river ecosystems. Island Press; Washington, D.C.

Drucker, P. 1965. Cultures of the North Pacific Coast. Chandler Publishing Company. San Francisco, California.

Fisheries Regulation and Assessment Model (FRAM). 2003. Chinook validation file for May 20, provided by W. Beattie, Conservation Planning Coordinator, Northwest Indian Fisheries Commission, Olympia, WA. Excel workbook.

FRAM. 2004. Final adopted preseason model run 1604 (Preliminary final PFMC: NT 89K and 49K treaty troll). April 14, 2004. Excel workbook.

Foley, Steve. Fisheries Biologist, Washington Department of Fish and Wildlife, Mill Creek, WA. February 19, 2004. Personal communication with Keith Schultz (NMFS NWR Sustainable Fisheries Division), regarding estimation of Lake Washington chinook population escapements.

Frissell, C.A. 1993. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. Prepared for Pacific Rivers Council; Eugene, Oregon.

Gilbert, C.H. 1912. Age at maturity of Pacific coast salmon of the genus *Oncorhynchus*. Bull. U.S. Fish Comm. 32:57-70.

Hage, Paul. Fisheries Management Biologist, Muckelshoot Indian Tribe, February 10, 2004. Personal communication, e-mail to Susan Bishop (NMFS NWR Sustainable Fisheries Division), regarding estimation of Lake Washington chinook population escapements.

Hare, S.R., N.J. Mantua, and R.C. Francis. 1999. Inverse production regimes: Alaska and West Coast Pacific Salmon. Fisheries 24: 6-14.

Healey, M.C. 1983. Coastwide distribution and ocean migration patterns of stream- and ocean-type chinook salmon, *Oncorhynchus tshawytscha*. Can. Field-Nat. 97:427-433.

Healey, M.C. 1986. Optimum size and age at maturity in Pacific salmon and effects of size-selective fisheries. Can. Spec. Publ. Fish. Aquat. Sci. 89:39-52.

Healey, M.C. 1991. The life history of chinook salmon (*Oncorhynchus tshawytscha*). *In* C. Groot and L. Margolis (eds.), Life history of Pacific Salmon. Univ. of British Columbia Press. Vancouver, B.C.

Henjum, M.G., and 7 co-authors. 1994. Interim protection for late-successional forests, fisheries, and watersheds: national forests east of the Cascade Crest, Oregon, and Washington. The Wildlife Society, Bethesda, Maryland.

Johnson, O.W., W.S. Grant, R.G. Cope, K.Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32, 280 pp.

Mantua, N.J., S.R. Hare, Y. Zhang, J.M. Wallace, and R.C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bull. Am. Meteorol. Soc. 78: 1069-1079.

Marshall, A. Unpublished. Puget Sound chinook salmon GSI dendogram (2000). 1 p.

McElhany, P. , M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42, 156 pp. http://www.nwfsc.noaa.gov/pubs/ .

McPhail, J.D., and C.C. Lindsey. 1970. Freshwater fishes of Northwestern Canada and Alaska. Bull. Fish. Res. Board Canada 173: 381.

Myers and 10 co-authors. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-NWFSC-35. 443 pp.

Nisqually Chinook Recovery Team (NCRT). 2001. Nisqually Chinook recovery plan. August, 2001. 63 pp. + appendices.

NMFS. 1990. Section 7 Consultation - Biological Opinion: Amendment 4 of the Pacific Coast Groundfish Fishery Management Plan. August 10, 1990. 16 pp.

NMFS. 1991. Section 7 Consultation - Biological Opinion: Pacific Coast whiting fishery and modifications in structure of the fishery. November 26, 1991. 18 pp.

NMFS. 1992. Endangered Species Act - Section 7 Consultation Biological Opinion: Fishing conducted under the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. August 28, 1992. 53 pp.

NMFS. 1993. Endangered Species Act - Section 7 Consultation Biological Opinion: Fishing conducted under the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. September 27, 1993. 9 pp.

NMFS. 1994. Section 7 Consultation - Biological Opinion: Groundfish fisheries conducted under the Bering Sea and Aleutian Island and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. January 19, 1994. 74 pp.

NMFS. 1995. Endangered Species Act - Section 7 Re-initiation of Consultation Biological Opinion: Groundfish fisheries conducted under the Bering Sea and Aleutian Island and Gulf of Alaska Fishery Management Plans of the North Pacific Fishery Management Council. December 7, 1995. 8 pp.

NMFS. 1996a. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. August, 1996. 28 pp.

NMFS. 1996b. Endangered Species Act Reinitiation of Section 7 Consultation - Biological Opinion: Fishing Conducted under the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery, May 14, 1996.

NMFS. 1996c. Endangered Species Act Section 7 Consultation - Biological Opinion. The Fishery Management Plan for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California of the Pacific Fishery Management Council. March 8, 1996.

NMFS. 1999a. Endangered Species Act - Reinitiated Section 7 Consultation - The Fishery Management Plan for Commercial and Recreational Fisheries off the Coasts of Washington, Oregon and California of the Pacific Fisheries Management Council. NMFS, Protected

Resources Division. April 30, 1999. 45 p.

NMFS. 1999b. Endangered Species Act - Section 7 Consultation Supplemental Biological Opinion and Incidental Take Statement - The Pacific Coast Salmon Plan and Amendment 13 to the Plan. NMFS, Protected Resources Division. April 28, 1999. 39 pp. plus attachment.

NMFS. 1999c. Endangered Species Act - Reinitiated Section 7 Consultation - Approval of the Pacific Salmon Treaty by the U.S. Department of State and Management of the Southeast Alaska Salmon Fisheries Subject to the Pacific Salmon Treaty. NMFS, Protected Resources Division. November 9, 1999. 90 pp. + figures.

NMFS. 1999d. Endangered Species Act - Reinitiated Section 7 Consultation - Fishing Conducted Under the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. NMFS, Protected Resources Division. December 15, 1999. 64 pp.

NMFS. 1999e. Endangered Species Act - Section 7 Consultation - Biological Opinion: Authorization of BSAI groundfish fisheries based on TAC specifications recommended by the North Pacific Management Council for 2000; authorization of GOA groundfish fisheries based on TAC specifications recommended by the North Pacific Fishery Management Council for 2000; and authorization for both BSAI and GOA groundfish fisheries based on statutes, regulations, and management measures to implement the American Fisheries Act of 1998. December 22, 1999. 352 pp.

NMFS. 2000a. Endangered Species Act - Reinitiated Section 7 Consultation - Biological opinion and incidental take statement- Effects of the Pacific Coast Salmon Plan on California Central Valley spring-run chinook, and California coastal chinook salmon. NMFS, Protected Resources Division. April 28, 2000. 31 pp.

NMFS. 2000b. Endangered Species Act - Reinitiated Section 7 Consultation - Effects of Pacific coast ocean and Puget Sound salmon fisheries during the 2000-2001 annual regulatory cycle. NMFS, Protected Resources Division. April 28, 2000. 99 pp.

NMFS. 2000f. RAP: A risk assessment procedure for evaluating harvest mortality on Pacific salmonids. NMFS, Sustainable Fisheries Division and NWFSC, Resource Utilization and Technology Division. May 30, 2000 draft. 33 pp.

NMFS. 2000g. Endangered Species Act - Section 7 Consultation Biological Opinion and Incidental Take Statement: Authorization of Bering Sea/Aleutian Islands groundfish fisheries based on the Fishery Management Plan for the Bering Sea and Aleutian Island groundfish, and authorization of the Gulf of Alaska groundfish fisheries based on the Fishery Management Plan for groundfish of the Gulf of Alaska. November 30, 2000. 352 pp.

NMFS. 2001a. Joint State Tribal Resource Management Plan provided by the Washington Department of Fish and Wildlife and the Puget Sound Tribes for salmon fisheries affecting Puget Sound Chinook salmon under Limit 6 of the 4(d) Rule - Determination Memo. Memo from William L. Robinson to Donna Darm. NMFS NW Region. April 26, 2001.

NMFS. 2001b. Joint State Tribal Resource Management Plan provided by the Washington Department of Fish and Wildlife and the Point No-Point-Treaty Tribes for salmon fisheries affecting Hood Canal summer chum salmon under Limit 6 of the 4(d) Rule - Determination Memo. Memo from William L. Robinson to Donna Darm. NMFS NW Region. April 26, 2001.

NMFS. 2001c. Endangered Species Act - Reinitiated Section 7 Consultation Biological Opinion and Incidental Take Statement - Effects of the Pacific Coast Salmon Plan and U.S. Fraser Panel fisheries on Upper Willamette River chinook, Lower Columbia River chinook, Lower Columbia River chum. NMFS Protected Resources Division. April 30, 2001. 55 pp.

NMFS. 2001e. Endangered species act - section 7 consultation and Magnuson-Stevens act essential fish habitat consultation - biological opinion on artificial propagation in the Hood Canal and eastern Strait of Juan de Fuca regions of Washington state. Sustainable Fisheries Division, National Marine Fisheries Service, Northwest Region. Portland, OR. 277pp.

NMFS. 2002b. Review of Chinook bycatch during 2000 and 2001 Pacific Coast Whiting fisheries and National Marine Fisheries Services (NMFS) Endangered Species Act (ESA) Section 7 Consultation of 1999 for the Pacific Coast Groundfish Fishery Management Plan. NMFS, Sustainable Fisheries Division. April 25, 2002. 23 pp. plus appendix.

NMFS. 2002c. Endangered Species Act (ESA) section 7 consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation, Chief Joseph Dam tailrace fishery from 2002 through 2012. December 19, 2002. 38 pp.

NMFS. 2003a. The Endangered Species Act (ESA) section 7 consultation/Magnuson-Stevens Act Essential Fish Habitat (EFH) Consultation: Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component - ESA section 4(d) Decision/Determination. May 20, 2003. 39 pp.

NMFS. 2003b. Endangered species act - section 7 consultation and Magnuson-Stevens act essential fish habitat consultation - biological opinion on NMFS' review of three section 10(a)(1)(A) permit actions involving artificial propagation that may affect Upper Columbia River (UCR) steelhead and Upper Columbia River spring chinook salmon. Salmon Recovery Division, National Marine Fisheries Service, Northwest Region. Portland, OR. 87p.

NMFS. 2003c. A joint Tribal and State Resource Management Plan (RMP) submitted under Limit 6 of the 4(d) Rule by the Puget Sound Treaty Tribes and Washington Department of Fish and Wildlife for salmon fisheries and steelhead net fisheries affecting Puget Sound chinook salmon - Decision Memorandum. Memo from William. L. Robinson to D. Robert Lohn. NMFS NW Region. May 19, 2003.

NMFS. 2004a. Puget Sound Chinook harvest resource management plan draft environmental impact statement. NMFS Northwest Region with assistance from the Puget Sound Treaty Tribes and Washington Department of Fish and Wildlife. April, 2004. 1,166 pp including appendices.

NMFS. 2004b. Endangered Species Act - Section 7 Consultation (Puget Sound) and Re-initiated Section 7 Consultation (Lower Columbia River) - Biological Opinion and Incidental Take

Statement and Magnuson-Stevens Act Essential Fish Habitat Consultation. Effects of the Pacific Coast Salmon Plan and U.S. Fraser Panel Fisheries on the Puget Sound Chinook and Lower Columbia River Chinook Salmon Evolutionarily Significant Units. NMFS Sustainable Fisheries Division. April 29, 2004. 89 pp.

NMFS. 2004c. Endangered Species Act - Section 7 Consultation - Biological Opinion and Incidental Take Statement and Magnuson-Stevens Act Essential Fish Habitat Consultation. Effects of the Pacific Coast Salmon Plan on the Sacramento Winter-Run Chinook Salmon Evolutionarily Significant Unit. NMFS Sustainable Fisheries Division. April 28, 2004. 89 pp.

NMFS. 2004d. ESA species list - Endangered and threatened marine mammals and sea turtles under the jurisdiction of the National Marine Fisheries Service (NMFS) that may occur in the Puget Sound, at http://www.nwr.noaa.gov/mmammals/whales/nonkw/marmamlist.html. Web site accessed May 6, 2004.

Nisqually Chinook Recovery Team (NCRT). 2001. Nisqually chinook recovery plan. August 2001. 59 pp. + Appendices.

Norberg, Brent. Marine Mammal Coordinator, NMFS, May 6, 2004. Personal communication with Susan Bishop (NMFS NWR Sustainable Fisheries Division), regarding fishing-related encounters of listed sea turtles and marine mammals under NMFS' jurisdiction in Puget Sound.

Pacific Fisheries Management Council (PFMC). 1998a. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. December 1998.

PFMC. 1998b. Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Coast Groundfish Plan. October 1998.

PFMC. 1999. Appendix A to Amendment 14 to the Pacific Coast Salmon Plan. Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon. 146 pp.

Pacific Salmon Treaty (PST). 1999. U.S.-Canada agreement relating to the Pacific Salmon Treaty, June 30, 1999, Annex IV, Chapter 4.

Pacific States Marine Fisheries Commission (PSMFC). Regional mark information service December 2002 database search of coded-wire tag recoveries by The William Douglas Company, Seattle, WA.

Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife (PSIT/WDFW). 2003. Puget Sound comprehensive management plan: harvest management component. February 19, 2004. 239 pp.

Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife (PSIT/WDFW). 2004. Comprehensive management plan for Puget Sound chinook: harvest management component. March 1, 2004. 247 pp.

Puget Sound Salmon Management Plan (PSSMP). 1985. United States v. Washington (1606 F. Supp. 1405).

Puget Sound Salmon Stock Review Group (PSSSRG). 1997. An assessment of the status of Puget Sound chinook and Strait of Juan de Fuca coho stocks as required under the Salmon Fishery Management Plan. Pacific Fishery Management Council Review Draft, 78 p. (Available from the Pacific Fishery Management Council, 2130 Fifth Ave., Ste. 224, Portland, OR 97201.)

Puget Sound Technical Recovery Team (PSTRT). 2002. Planning ranges and preliminary guidelines for the delisting and recovery of the Puget Sound chinook Salmon Evolutionarily Significant Unit. April 30, 2002. 17 pp.

PSTRT. 2003a. Abundance and productivity data tables summarizing key biological and life history data for the North Fork Nooksack early chinook population. NOAA Fisheries, Northwest Region, Seattle, Washington. Excel workbook. November 11, 2003.

PSTRT. 2003b. Abundance and productivity data tables summarizing key biological and life history data for the Skagit summer fall chinook populations. NOAA Fisheries, Northwest Region, Seattle, Washington. Three Excel workbooks. July 30, 2003.

PSTRT. 2003c. Abundance and productivity data tables summarizing key biological and life history data for the Skagit spring chinook populations. NOAA Fisheries, Northwest Region, Seattle, Washington. Three Excel workbooks. October and November, 2003.

PSTRT. 2003d. Abundance and productivity data tables summarizing key biological and life history data for the North Fork Stillaguamish chinook population. NOAA Fisheries, Northwest Region, Seattle, Washington. Excel workbook. November 13, 2003.

PSTRT. 2003e. Abundance and productivity data tables summarizing key biological and life history data for the Skykomish chinook population. NOAA Fisheries, Northwest Region, Seattle, Washington. Excel workbook. November 20, 2003.

PSTRT. 2003f. Abundance and productivity data tables summarizing key biological and life history data for the Duwamish-Green chinook population. NOAA Fisheries, Northwest Region, Seattle, Washington. Excel workbook. November 10, 2003.

PSTRT. 2004a. Independent populations of chinook in Puget Sound. Final draft January 24th, 2004. NMFS, NW Region, NWFSC. Seattle, Wa. 61 pages plus appendices.

PSTRT. 2004b. Abundance and productivity data tables summarizing key biological and life history data for the Snoqualmie chinook populations. NOAA Fisheries, Northwest Region, Seattle, Washington. Three Excel workbooks. January 5, 2004.

Rawson, K., Tulalip Tribe, Marysville, WA. April 13, 2004. Personal communication, e-mail to Susan Bishop (NMFS NWR Sustainable Fisheries Division), regarding preseason escapement estimates for the Skykomish, Snoqualmie, North Fork Stillagumish and South Fork Stillaguamish River chinook populations.

Ricker, W.E. 1959. Evidence for environmental and genetic influence on certain characters which distinguish stocks of the Pacific salmons and steelhead trout. Fisheries Research Board of Canada, Biological Station, Nanaimo, B.C.

Ricker, W.E. 1972. Hereditary and environmental factors affecting certain salmonid populations. *In* R.C. Simon and P.A. Larkin (eds.), The stock concept in Pacific salmon. MacMillan Lectures in Fisheries. Univ. British Columbia; Vancouver, B.C.

Simmons, D., National Marine Fisheries Service, Seattle, WA. 2003. Personal communication, e-mail to Susan Bishop (NMFS NWR Sustainable Fisheries Division), regarding estimates of marine survival for Puget Sound, Washington Coastal and British Columbian chinook stocks.

Simmons, D., National Marine Fisheries Service, Seattle, WA. April 1, 2004. Personal communication, e-mail to Susan Bishop (NMFS NWR Sustainable Fisheries Division), regarding estimates and distribution of exploitation rates for Puget Sound and Lower Columbia River chinook.

Skagit Rebuilding Exploitation Rate Workgroup. 2003.

Snohomish Basin Salmon Recovery Technical Committee (SBSRTC). 1999. Initial Snohomish River Basin chinook salmon conservation/recovery technical work plan. October 6, 1999. 109 pp. + appendices.

Spence, B.C., G.A. Lomnicky, R.M Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp. Corvallis, Oregon. 356 pp.

Stanford, J.A., and J.V. Ward. 1992. Management of aquatic resources in large catchments: recognizing interactions between ecosystem connectivity and environmental disturbance. Pages 91-124 *in* R. J. Naiman, editor. Watershed management: balancing sustainability and environmental change. Springer-Verlag, New York.

Taylor, E.B. 1991. A review of local adaptation in Salmonidae, with particular reference to Pacific and Atlantic salmon. Aquaculture 98:185-207.

Washington Department of Fisheries (WDF), Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State salmon and steelhead stock inventory (SASSI). Wash. Dep. Fish and Wildl., Olympia, 212 pp. + 5 regional volumes.

WDFW, Puyallup Indian Tribe and Muckleshoot Indian Tribe. 1996. Recovery Plan for White River spring chinook salmon. July 1996. 81 pp.

WDFW and the Point No Point Treaty Tribes (WDFW/PNPTT). 2000. Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region. J. Ames, G. Graves and C. Weller (eds.). Wash. Dep. Fish and Wildl., Olympia, http://www.wa.gov/wdfw. 423 pp. + appendices.

WDFW and the Puget Sound Treaty Tribes (WDFW/PSTT). 2001. Puget Sound Comprehensive

Chinook Management Plan Harvest Management Component. February 7, 2001. 31 pp. + appendices.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon and California. NOAA Tech. Memo. NMFS-NWFSC-24, 258 pp.

West Coast Biological Review Team (WCSBRT). 2003. Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead. West Coast Biological Review Team. Northwest Fisheries Science Center, Seattle, WA. Southwest Fisheries Science Center, Santa Cruz, CA. July 2003.